THE Chemical Age

VOL. LXXI 18 DECEMBER 1954 No. 1849

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Rubber saves a Reservoir

WHEN MINING SUBSIDENCE caused severe cracking in the concrete floor and walls of the Mill Hill Reservoir at Easington, ordinary caulking and repairing could not make this extensive structure watertight. Quantities of stored water were lost and the district supply was frequently in danger of interruption. The Sunderland and South Shields Water Company's Engineers consulted Dunlop with the suggestion that rubber lining might solve their problem.

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Volume LXXI
Number 1849

The Chemical Age

Established 1919

The Weekly Journal of Chemical Engineering and Industrial Chemistry

BOUVERIE HOUSE · 154 FLEET STREET · LONDON · EC4

Telephone: CENTRAL 3212 (26 *lines*) *Telegrams:* ALLANGAS · FLEET · LONDON

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The Whitehall Centenary

LAST week a reception at County Hall, attended by the Prime Minister, was a further tribute to the 1954 centenary of the British Civil Service. Many may find it difficult to believe that the civil service is only 20 years older than Sir Winston himself, but Whitehall's birthday has a somewhat technical explanation. What is 100 years old is the historic Trevelyan-Northcote report that founded the organisation of the modern civil service as we know it today. Civil servants have been with us considerably longer —Pepys's diary and Trollope's autobiography give evidence enough of that.

It is typical of our national sense of humour that we should cherish quite incompatible ideas about our civil service. Most of us are ready enough to enjoy jokes in which the civil servant is as hackneyed a character as the interfering mother-in-law or the thrifty Scot; at the same time most of us are equally ready to say that our civil service is by far the best in the world and the most incorruptible. The tea stains on the files may be innumerable for purposes of easy laughter, but the stains of unprofessional conduct have been so few and far between in the modern civil service's history that we can take even more easily for granted the rectitude of this vast network of administration. Nevertheless, in the last 15 years of Whitehall's story the functions of the civil service have both widened and deepened, and the pattern forged in 1854 has been inevitably subjected to many new strains and stresses. Whitehall has had to try to fulfil the demands of a rapidly changing age, an age in which an entirely new outlook towards the relationship between the State and the individual has developed.

In the war and post-war years many tasks were given to the civil service for which its resources and machinery had not been designed. The word 'bureaucracy' has hardly ever been objective, but it has become much more malodorous since 1940. The public has sensed that those who were once its civil servants have increasingly become its civil masters. The logical fact that this is merely a consequence of 'controls' has all too commonly been ignored. Yet the civil service has no responsibility for creating 'controls' nor for continuing their existence—this falls upon the elected political administration. It may well be that this has been more widely and fairly appreciated during the past few years when a political change decided by the electorate has led to a steady and substantial reduction in 'controls.' But, if so, it seems to have come too late—or perhaps there has not yet been time—for the lost prestige of the civil service to be recovered.

The civil service is still held in great respect but there has been a significant lessening of public goodwill towards it. There is certainly a minority among the public, often vociferous though hardly organised, that is almost viciously antagonistic, taking unbalanced delight in exaggerating any episode, however petty, which shows the civil service to be long-winded, impractical, or even just humanly capable of making a clerical error. It is seldom realised by these

critics that most senior civil servants are only too conscious of the faults in the service, only too aware that the huge modern expansion in its tasks has created many problems in staffing and organisation, and are deeply concerned that the climate of relationship between Whitehall and the public has deteriorated. None of this is put forward as an apologia for the civil service; THE CHEMICAL AGE has done its share of criticising the operation of 'controls.' But this is an appropriate time to put such matters into their just perspective, and to acknowledge that most of the imperfections are by-products of the large and still unsolved problem of our age, how to change ourselves as rapidly as our environment is changing, how to give an engine new capacity without blowing the proven safety-valves.

A system drawn up as long ago as in 1854 may have displayed many virtues during the century since but this still does not prove that the same system can meet the conditions of the next century with similar effectiveness. We might even discount the difficult decade when so many 'controls' were deemed necessary and when the civil service was so demonstrably over-loaded. We cannot afford to discount as well another problem of the civil service in our time and one that has in no way lessened with the shedding of 'controls,' a modern problem that increases each year in importance. That is the use that the civil service makes of science, the extent to which its system can absorb scientifically trained people so that the dough of administrative professionalism is leavened by the potentialities of twentieth century technology.

The history of specialists in the civil service is not wholly a happy or creditable one. In a pre-war history of the Higher Civil Service, it was said: 'If a specialist complains that he is persistently ignored by the administrative staff of the Department, the reason is almost certain to be something in himself.' There is a 'passed-to-you-please' atmosphere about this 1939 verdict that few thinking people can possibly find acceptable, and it surely reflected the tendency of an administrative class to go to all lengths to treat scientific advisers as interlopers. The position of scientists in the civil service has improved substantially since then, as it also has in business and in industry.

Nevertheless, a recent review of their position, in *The Political Quarterly* by Mr. H. R. C. Greaves, and commented upon by *Nature* (1954, **174**, 983), admits that their numbers still amount to only a weak group, and although scientists are now employed closer to the points of administrative decision only a few have been able to attain some of the highest administrative posts. To quote one of the comments made in *Nature*: 'He (Mr. Greaves) admits that a widening of the social basis of recruitment to the administrative class might also assist in the recruitment of those whose university training had been in science and not solely in the arts.' It is clear from this admission that the current outlook in the civil service still clings to past ideas, and lags seriously behind industry in recognising the full capabilities of scientists. 'Experts on tap but never on top' is an old and wasteful adage that industry has learnt to forget. If the scientific civil servant is confined to a purely advisory role, it means that administrators whose training has predominantly been in 'the arts' must themselves decide when science can make a contribution to a task of national administration and when it cannot do so. Also, if it is far from easy for scientists in the civil service to achieve the 'plums' of office by eventual promotion, in sharp contrast to the situation in industry, it is certain that departments will experience increasing difficulty in attracting the better quality of young scientists.

To indulge in criticism in noting an important institutional centenary is perhaps invidious. But nothing stands out more obviously than the fact that the civil service of 1954-2004 will have vastly different functions from those of 1854-1954. If the pattern is not to be fundamentally changed, it must be considerably re-shaped. Time in this second half of the twentieth century is not on the side of slow evolution as it has been during most of the past hundred years. The greater utilisation of science by the permanent administration of this industrial country has an urgency that must not be pushed aside by tradition.

Notes & Comments

British Dyes

A RECENT article in *The Financial Times* (22 November) gave an exceedingly heartening picture of the progress of our dyestuffs industry, especially in the field of exports. Our share of international trade in this class of chemicals is earning more than £1,000,000 a month, yet the dyestuffs industry is still, as it always has been, one of the most highly competitive. Germany's famous dyestuffs industry emerged from the war with much less damage than had been expected. Switzerland, traditionally an active producer, has never had a domestic market able to take more than 5 per cent of her production, and her position during the war gave her an unrivalled opportunity to expand. Nevertheless, in monetary value, we have been selling from five to seven times the amount of dyestuffs we sold abroad each year before the war. By comparison international trade has risen, again in terms of monetary value only, between two and three times its annual pre-war figure; broadly speaking, this reflects little more by way of expansion than the general rise in prices. This means that we have doubled our own share of the total export trade in dyestuffs since the war. There was a sharp fall in world trade during the textiles depression of 1952 and 1953. World sales of dyestuffs fell by as much as 42 per cent in 1952 and 25 per cent in 1953; but British sales fell from their 1951 level by only 24 per cent and 14 per cent in those two years of recession. Perhaps there is no better measure of genuine strength than the ability to lose much less than competitors on a falling market. The general drop in demand seems to have come to an end; both for world trade and our share in it, figures for the first six months of 1954 have revealed the best expansion since the end of the war. Putting 100 as the annual pre-war value of dyestuffs trade, the 1954 figures stand at 335 for total world trade and 745 for the UK portion. Not even the most plaintive critic can find a trace of trouble in an export performance of this kind.

Struggle to Come

ONE reason for the great improvement in our fortunes is that increased efficiency has kept prices down. In the past five years the average price of British dyestuffs has risen by only 29 per cent while the price level of all materials used by the textiles industry has risen by 48 per cent. Nevertheless, there can be no resting upon these post-war laurels. Germany, so powerful a pre-war producer and exporter, has yet to recover her former volume of output. When she does, the retention of our gains in world dyestuffs trade will call for harder work than was needed for their achievement. Steady technical improvement and highly specialised technical salesmanship must be the twin weapons of effort. We threw away the great

opportunity that the youthful W. H. Perkin gave us almost a century ago. We must not lose what has been regained.

Chemicals v. Flames

THE Fire Research Board Committee's Report on vaporising liquid extinguishing agents has now been issued (HMSO, 1s.) and its recommendations will not surprise students of this subject. Chlorobromomethane is preferred to carbon tetrachloride—it is more efficient as a fire extinguishing agent and it carries a lower toxic risk. A third point in its favour is that it can be used without much need for modification in appliances originally designed for using carbon tetrachloride. Chlorobromomethane is also preferred to methyl bromide in many fire circumstances. However, there is more than a possibility that carrying this process further still—to fluorine—is even better. The Committee is obviously impressed by the promise of the fluorobromo hydrocarbons notwithstanding the fact that they cost a good deal more to produce, and has emphatically recommended that the development of these newer chemical agents should be continued.

Fluorocarbons Indicated

COST is not in any case a major factor in this field—or should not be. If fires do not occur, the chemical substance remains inside the extinguisher. If a fire occurs, efficiency in preventing its development has a far larger economic significance than the basic cost of the chemical substance applied to the flames. Also, when large quantities of chemical anti-fire material are flung into the flame front, a material that is more efficient may well overcome its disability of high cost through the fact that much less may in fact succeed in extinguishing the fire. The effectiveness of small amounts of fluorocarbon substances is indicated in the current issue of *Industrial & Engineering Chemistry* (1954, **46**, [11] 17A). As little as 0.002 or 0.003 per cent by weight of new fluorocarbon surfactants will reduce the surface tension of quite volatile liquids (e.g., petrol) by remarkably large amounts. A beaker of petrol thus treated still held 75 per cent of its original volume after 2½ days exposure to the air; an untreated beaker of petrol after the same length of exposure had almost completely evaporated. The capacity of fluorocarbons to repress volatility is only beginning to be appreciated. Also, the range of synthetic fluorocarbon molecules is still in its earlier days of diversity. We may well look towards this new family of chemical compounds for the fire extinguishing agents of the future.

Titanium Find Reported

It is reported from Cape Town that rich deposits of titanium in the form of the mineral ilmenite have been discovered on the Namaqualand coast.

Part of the Shell exhibition of Epikote resins in London last week. Similar exhibits will be staged in Birmingham, Manchester and Glasgow early in the new year

Lords Discuss Technological Education

Government Announce £15,000,000 Expansion Plans

GOVERNMENT plans for developing higher technological education, at a cost of about £15,000,000, announced in both the House of Commons and the House of Lords last week, provide for the 'massive expansion' of the Imperial College at South Kensington. They also provide for major developments at Glasgow, Manchester, Leeds and Birmingham, developments 'on a fairly large scale' at Cambridge and Sheffield and specialised developments at other centres in the country, including Wales.

Some are financed by industry and some by Treasury grant. The more notable are at Edinburgh, Newcastle, Southampton, Nottingham and Swansea. The expansion of Imperial College involves giving the college first claim on those parts of the rectangular island site in South Kensington lying between Prince Consort Road and Imperial Institute Road which it did not already occupy. Building works to the extent of £1,200,000 are in progress on the northern part of the site, and further progress will soon require the release of some other parts of the site from their existing use.

These details were given by Lord Salisbury (Lord President of the Council) during a debate on higher technological education in the House of Lords on 7 December which had been opened by Lord Glyn, chairman of the special committee of the Parliamentary and Scientific Committee set up to consider the matter.

Britain Lagging Behind

Lord Glyn maintained that this country lagged behind almost every other country in the amenities and facilities provided to give people the opportunity of becoming qualified in work which involved technical knowledge. 'The United States, per head of the population, are turning out four and a half times as many technologists as we are in this country,' he went on. 'On the other hand, the United Kingdom turns out nearly five times as many pure scientists per head of the population as the United States.' This situation led to the fact that while this country spent a great deal of effort on research, others reaped the benefit of its application and development.

The report of the committee suggested that certain technical colleges, provided they had reached a very high standard, might be upgraded and called Royal Charter colleges, Lord Glyn said. 'Then, of course, one would hope that appropriate awards would be given by those Royal Charter colleges. To me, at any rate, it was extraordinary that, although at the universities a person could be called Bachelor of Arts or Master of Arts, he could not be called a Bachelor of Technology or a Master of Technology.' The committee also hoped that the colleges which were upgraded would be removed from the sphere of local rates and be made independent organisations.

Statement Challenged

Lord Silkin challenged the statement that this country was behind others in the provision of technologists and suggested that before embarking on a vast programme of expansion of technology it would be better to have some idea of what sort of numbers were being aimed at. He asked the House to suspend judgment until it had had an opportunity of a full investigation into requirements and into existing and prospective facilities for meeting these requirements.

Lord Falmouth spoke of an immense demand for higher grade technologists and said there was no question of the demand reaching saturation point for many years. The predominant position of the United States in production was largely due to the high-grade men they had on the floor of their shops.

'These men, brought up with a scientific bias, are able to see in what direction improvements can quickly be made, and it is largely due to them that we see this enviable improvement in productive capacity compared with what we have in this country,' he said.

He disagreed with the suggestion that upgraded colleges should confer degrees or awards. 'I do not think we want any more awards,' he said.

Lord Waverley maintained that if degree-granting powers were not given, 'we shall inevitably convey the impression that we are not in earnest about this matter.'

Lord Cherwell described technicians produced by technical colleges as the non-commissioned officers of industry. The universities, thanks largely to the help of the University Grants Committee, were as good as any in the world, but what was wanted today was an increase in the type of man quite different from those produced in the older faculties. 'I am convinced that we cannot get them—certainly not in the required numbers—from the existing universities.'

Proof of the need for more technologists, Lord Baillieu said, could be found in the weekly advertisements of the trade and technical Press.

Lord Salisbury, speaking for the Government, said: 'The position with regard to the schools is clearly of fundamental importance. . . . The Government fully recognise the vital importance of getting an adequate supply of teachers for the schools. Although the position is not yet critical, it is, I admit, very serious.'

The idea of a technological university, he went on, was not at present a practical possibility. A large number of scientists were opposed to it.

Revolutionary or Evolutionary?

The Government believed that we should look mainly to the university system for a supply of technologists, but technical colleges were not entirely excluded and facilities would be improved. The only difference between the Government and the committee, he thought, was that the committee suggested the establishment of advanced technical colleges by 'what I have, perhaps rashly, called a revolutionary procedure.' The Government preferred to develop advanced work in selected colleges by evolutionary methods, making sure that development fitted in with requirements of industry on a local, or regional basis.

Lord Caldecote suggested a scheme by which a few technical colleges would be selected for increased grants, upgraded and called Royal technical colleges with the ultimate aim of being independent and being able to give their own associateship award. The award would be equal in value, although different in scope, to a degree. As an interim scheme there should be a national diploma supervised by a central board whose members should be qualified academically and professionally.

Lord Halsbury said: 'I often think it is a very good thing for those of us who have anything to do with building to leave this Parliament at Westminster and walk on the Embankment past Victoria Tower, to look at the big Imperial Chemical Industries building and to remember that it was built in 18 months. Our competitors are not standing still. We have drifted into contentment with a tortoiselike rate of progress, and I do not believe that we can afford it.'

Glaxo in Dublin

GLAXO Laboratories' new offices and warehouse at 35/37 Grand Canal Street Lower, Dublin, are now in commission. For the past 23 years May Roberts (Ireland) Ltd. had been the distributing organisation for Glaxo products in Eire, but with the rapid expansion of the company's business in Ireland it was found necessary to set up a permanent headquarters in Dublin. This first phase in the development of Glaxo's interests in Ireland has been completed at a cost of £30,000.

The new building comprises a modern two storey structure which will be used to store penicillin, streptomycin, radiological preparations, Intradex (the blood plasma substitute) and a wide range of the company's veterinary and other pharmaceutical products. The office accommodation includes a conference room and a general office.

In charge of the new project is Mr. Donald MacKenzie, F.S.M.A., the company's manager in Ireland. Mr. MacKenzie has been with Glaxo for over 30 years.

Borax Consolidated Ltd.

The board of Borax Consolidated Ltd. have issued a statement which shows that the interim trading profits of the parent company for the nine months ended 30 June were £1,205,204 (subject to audit), compared with £963,072 in the same period of 1953. Trading results, for the last quarter of the financial year, it is stated, continued to run well ahead of those of the same period of 1953. As reported last week, discussions are taking place to see whether terms of an offer can be formulated that would form the basis of an application to the Treasury for consent to a change of domicile of the company from the UK to the US.

Catalytic Oil Gas Plant

Improved Process Planned for Ponders End

AS we reported in our last issue (p. 1205), the Eastern Gas Board has placed a £130,000 order with The Power-Gas Corporation Ltd. for a SEGAS catalytic oil gas installation at Ponders End. This order may be claimed to represent an important step forward in the development of the SEGAS process, since it will be a unit embodying all the accumulated experience gained in the operation of the Sydenham and York plants which were to some extent prototype units.

Stanier and McKean published a paper in 1950 (*Trans. Inst. Gas Eng.*, 1950-51, **100**, 176) setting out the principles of the process, which have been established for some years. The process originated in the laboratories of the former South Metropolitan Gas Company and, under nationalisation, was continued by the South Eastern Gas Board.

In due course an agreement was made whereby The Power-Gas Corporation Ltd. became the sole licensee for the commercial development of the process. The plant is designed to produce from oil a gas with calorific value, specific gravity and combustion characteristics similar to town's gas.

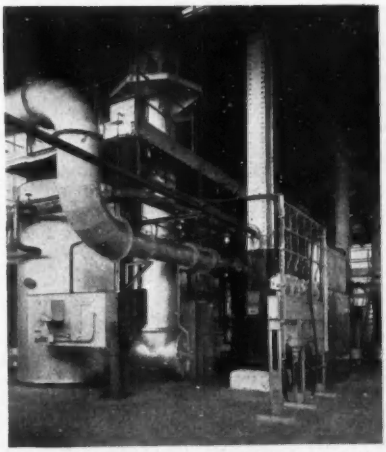
The unit at Sydenham was the first SEGAS catalytic oil gas plant in Britain to produce town's gas from oil on a commercial scale and over 600,000 gallons of heavy fuel oil have already been used (Inst. Gas Eng., *Communication No.* 457, 1954). The York plant has shown itself to be equally efficient. These two units, however, are of the three-vessel type, whereas the plant to be installed at Ponders End will have two vessels and incorporate a vaporising chamber to make even more efficient the vaporisation of heavy fuel oil in steam before it reaches the catalyst bed. This modification of design, together with its greatly increased capacity compared with the two former units, gives the Ponders End project special significance.

A waste heat boiler fitted with ancillary oil burners will provide the whole of the steam requirements. Turbine driven air blowers will use this steam and exhaust into a low pressure system from which, in turn, the process steam requirements of the plant are drawn. Provision is made for a cooling tower over which the scrubbing liquid for the direct contact washer cooler is circulated. This will not only reduce the amount of effluent for disposal to a minimum but will help to improve its quality.

Tar treatment will be carried out by surface active agents as experience has shown that these are effective in reducing the water content of tar from SEGAS plant to less than 5 per cent without further treatment. Such tar is acceptable to chemical plants as a saleable product or may be used as burner fuel, which possibility is arranged for in the Ponders End plant.

Extension of the plant by another SEGAS unit will not require any increase in the size or number of ancillaries (such as blowers, pumps, etc.) since the two units would operate in cyclic step. The increased process steam available would therefore be well in excess of the needs of the steam driven machines.

The Ponders End plant will be the first installation constructed by The Power-Gas Corporation Ltd. which has not been constructed specifically for development purposes. It will be in full operation by the Autumn of 1956.



General view of the SEGAS installation at Sydenham

Sugar Juice Clarification

Monsanto Investigations Show Value of Polyelectrolytes

DURING investigations on the industrial applications of synthetic polyelectrolytes it was discovered that they were excellent flocculating agents suitable for use in the clarifications of sugar juice, according to the Sales Development Group, Monsanto Chemicals Ltd.

These materials are high molecular weight polymers which dissociate in water to give negatively charged particles with a large number of centres and have the property of flocculating highly dispersed lime suspensions of the type frequently encountered in sugar extraction and refining. The mode of action is not clearly understood, but it has been suggested that the polyelectrolyte forms 'bridges' between the particles in raw sugar juice which has been partially flocculated with lime and absorbs neighbouring particles to form large rapidly settling flocs.

Considerable promise has been shown in facilitating the filtration of troublesome juice or liquor which can be reflected in any of the following ways: increased rate of flocculating and settling; reduced mud values; more easily filtered muds to give cleaner and brighter filtrates; increased grinding rate and sugar yield; reduced lime consumption with elimination of many difficulties associated with high lime concentrations; and improved clarification over a wide *p*H range.

Two Types Available

Two alternative products, Lytron X-886 and RD. 4054, are available and it is suggested that both these should be examined on a laboratory scale as a preliminary to plant evaluation so that the optimum conditions can be obtained.

Instructions for the preparation of a solution of Lytron X-886 are as follows: to make a 5 per cent w/w solution add 5 parts of Lytron X-886 to 95 parts of water, stirring all the time. Stirring should be rapid enough to prevent clumping without causing foaming. Allow to stand for 1 to 2 hours and complete solution by further stirring.

For RD. 4054 dissolve the synthetic polyelectrolyte by slowly stirring 10 grams of the solid into 90 grams of water and continue stirring until solution is complete. To 10 parts of this 10 per cent solution add 8 parts of normal sodium hydroxide and 2 parts of water to give a solution containing 5 per cent w/w of resin of *p*H 8.1-8.4. If the *p*H is more than half a unit outside these limits, adjust the value by the addition of fresh un-neutralised solution or sodium hydroxide solution.

For laboratory testing a convenient method of obtaining the 10, 20 and 40 ppm. concentrations is to dilute 5 ml. of the 5 per cent stock solution to 250 ml. with water so that 1 ml. of the 1,000 ppm. solution made is equivalent to a 10 ppm. concentration of polyelectrolyte when added to 100 ml. of sugar juice.

Preliminary Testing

For a preliminary demonstration take representative 100 ml. samples of sugar juice in boiling tubes in a bath at 70-80° C. Treat these with the synthetic polyelectrolyte at the concentrations given above, leaving one sample untreated as a control. Allow the juice to stand and compare the amounts of sediment after a convenient time.

Pour each sample of juice into a funnel, preferably steam jacketed to maintain the temperature at about 70° C, and allow the solution to filter through a fast paper, such as a Whatman No. 1, 4, 31 or 41. Compare the times required for 10 ml. of the juice to pass through each filter.

In a detailed laboratory evaluation, follow the same procedure but determine the effect of various factors such as the adding of lime before or after the polyelectrolyte. In most cases it will be found that the juice should be mixed and limed before the polyelectrolyte is added.

Experience to date has shown that the polyelectrolytes tend to be more active under plant conditions than in the laboratory, and slightly lower concentrations can be expected to give satisfactory results.

The polyelectrolyte should normally be introduced after lime addition but before heating. Under test conditions, a 1.5 per cent w/w aqueous solution gravity fed from a 50 gallon drum should be convenient. The use of two drums will enable one to be used for preparing further solutions while the other is delivering.

Recent Advances in Analysis of Plastics

*by J. HASLAM, D.Sc., F.R.I.C.**
(Chief Analyst, Imperial Chemical Industries Ltd., Plastics Division)

IN preparing a lecture on a subject such as 'Recent Advances in Plastics Analysis' it seems to me that one or other of two courses may be adopted. Either one can make an exhaustive survey of the literature, in which case it may be difficult to assess the relative importance of the various papers, or, alternatively, it may be possible—as in my case, being a worker in the field—to adopt quite a different attitude, i.e., to look back four or five years at the work being carried out in one's own laboratory and to study the changes which have taken place throughout that time. The latter course will enable one to draw attention to papers which have influenced our work and probably give opportunities to stress important points. I decided to work from this angle as being one which would probably be most helpful to other analysts.

At the time in question there was available a very useful paper by Shaw[1] which was published in *Industrial & Engineering Chemistry, Analytical Edition*, on a 'Systematic Procedure for the Identification of Synthetic Resins and Plastics.' This procedure was one of the very few which could be regarded as systematic and, although a certain amount of analytical information was scattered about the literature, the work of Shaw was about the only place one could turn to in trying to give useful information about miscellaneous plastic materials arising from all quarters of the globe; there was, at that time, feverish activity all over the place.

Shaw's Procedure

Shaw's procedure was, in general, based on the following lines :—

1. Removal of vehicles and solvents usually by a solvent/non-solvent process.

2. Division of the resins into classes by determination of the elements, e.g., N, S and Cl, and also determination of saponification value and acetyl number.

3. Determination of the position of a resin in a class by taking account of such properties as (a) solubility of the resin in organic solvents; (b) behaviour on ignition (this test is the stand-by of all technical servants in the plastics industry—a good thing for the analyst because as a test it is often inconclusive and hence the particular sample finds its way to the analyst for a more detailed examination); (c) physical properties such as specific gravity and refractive index; and (d) specific tests such as the diphenylamine test for nitrocellulose, the Liebermann Storch reaction and tests for formaldehyde.

A Useful Book

In addition to Shaw's paper I should like to draw attention to a useful book by Thinius[2], 'Analytische Chemie der Plaste,' which was published in 1952. This book gives useful information about the raw materials and the methods of identification of plastics. It deals with those plastics derived from raw materials on a cellulose basis, e.g., cellulose nitrate; other plastics derived from raw materials on a plant and animal basis other than cellulose and rubber, e.g., casein; plastics obtained by polymerisation, e.g., polymethyl methacrylate; and plastics obtained by polycondensation, e.g., nylon. Finally, there are useful chapters on plasticisers, fillers and hints on analytical procedures. Unfortunately the book does not deal with analytical methods introduced since 1950 and, moreover, it does not appear to me that sufficient attention has been paid to the use of the more modern physical methods.

With that kind of background we came up against all kinds of analytical problems but it was soon quite obvious that we were not often concerned with the question of whether a given polymer was, for example, nylon or not, but what type of nylon or related polymer we were dealing with. We had to remove and identify the plasticiser in the first place but after that had to decide such questions as: Were we dealing with 6 : 6, 6 : 10 or 6 nylon or a copolymer of these? Was it Polymer R or Perlon U or was it methoxymethyl nylon? We set to work from two angles.

1. The breakdown of the nylon chemically with hydrochloric acid[3] was followed by the determination of the proportions of the breakdown products and the properties of these products. Moreover, we had to study the analytical separation of the hydrolysis products in many cases. In these separations we had to

* A paper read at the International Symposium on Analytical Chemistry in Birmingham on 30 August.

make use of all kinds of methods, such as partition and use of ion exchange resins.

2. The determination of the infra-red spectra of all kinds of known nylon polymers[4] was made, and these were correlated with their chemical behaviour.

The combination of these procedures served us very well for some considerable time and enabled us to obtain a tremendous amount of information about this type of polymer. Moreover, with time, we were able to solve many analytical problems by simple direct determination of the infra-red spectrum. I want to make the point, however, that we could not solve all our problems in this field by the simple purchase and use of an infra-red spectrometer. Our difficulties arose, and do still arise, when new polymers are placed on the market and when the infra-red spectrum of the new polymer does not resemble that of any known polymer. It is in such cases as this that we must go back to our chemical methods of attack and I will give an example of this by reference to a problem which arose within recent months.

A Recent Problem

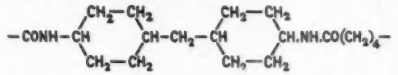
We received a new polymer for analysis, and infra-red examination indicated that although it was of a nylon type we had not met it previously. It was suggested to us that the material was a polymer of diaminodicyclohexyl methane. We examined the polymer by our normal hydrolysis methods and obtained the following figures :—

Per cent recovered acid ..	34.8
Per cent base hydrochloride	101.0

The figures were different from any we had previously found but, fortunately, one part of the puzzle was solved when we proved that the acid was adipic acid.

We were obviously not dealing with 6 : 6 nylon and our activities centred round the base hydrochloride. That base hydrochloride behaved as if it contained a certain proportion of the hydrolysis product of nylon 6, viz., ϵ-amino-caproic acid hydrochloride, by its behaviour on titration with standard alkali to phenolphthalein as indicator. We proved the point. We took some of the base hydrochloride and passed it down a column of the ion exchange resin Amberlite IRA-400 (in the active OH form)[5]. The material retained on the column was eluted with 2N hydrochloric acid and we were able to show that the hydrochloride recovered from the eluate was, in fact, ϵ-amino-caproic acid hydrochloride, derived from nylon 6.

Our figures show that the proportion of nylon 6 was 33.9 per cent. What was the other 66.1 per cent? We knew that it was derived from adipic acid on the one hand and by ion exchange work we were able to show that the base with which the adipic acid was combined was not hexamethylene diamine alone. We have been able to show, however, as a result of chromatographic and other work, that the base consists of a mixture of hexamethylene diamine and diaminodicyclohexyl methane. Hence we have reached the conclusion that our figures are consistent with the polymer being a copolymer of nylon 6 : 6, nylon 6 and the condensation product of diaminodicyclohexyl methane and adipic acid :



We have seen the development of other methods of attack on nylon polymers, notably the following :—

1. The hydrolysis of nylons and related polymers by Zahn carried out in sealed tubes with hydrochloric acid on very small amounts of polymer[6,7], which is followed by chromatographic examination of the hydrolysis products.

2. The direct chromatographic examination of nylon polymers by Miss Ayers[8]. This work was carried out at Pontypool.

3. The work of Ecochard and Duveau[9] which involves the potentiometric titration of the hydrolysis products of a nylon type polymer. This enables us to make rapid determinations of the proportion of the constituents in simple mixtures or co-polymers. In the case of 6 : 6 nylon, for instance, after hydrolysis with excess hydrochloric acid, followed by potentiometric titration with standard alkali, the first potentiometric end-point is obtained after all the excess hydrochloric acid has been used up, and the second end-point is obtained subsequently, when all the adipic acid has been used up. The hexamethylene diamine dihydrochloride plays no part in the titration.

In the case of nylon 6, the first end-point occurs when all the excess hydrochloric acid has been used up, and the second end-point when the hydrochloric acid of the HCl. $NH_2(CH_2)_5COOH$ has been titrated.

And now we will deal with the position of such polymers as polymethyl methacrylate or Perspex. Five years ago we were gradually

introducing the method of vacuum depolymerisation[10]. We sought to remove the plasticiser from the Perspex prior to the depolymerisation *in vacuo* with the production of first-class monomer. That monomer could be identified by combinations of physical and chemical procedures.

With that method we could obviously examine co-polymers of methyl methacrylate and, for example, styrene, studying the behaviour of the copolymer in the vacuum depolymerisation, i.e., the yield and the chemical and physical properties of the distillate.

We have always tried to work *in vacuo* and to carry out our depolymerisation work at a definite temperature, making our conditions as reproducible as possible. We have found the method to be useful in other connections, as in the detection of small proportions of methyl α-hydroxyisobutyrate in Perspex. Depolymerisation is controlled in the first place at one temperature in order to remove water, which is solidified as ice in the receiver. The temperature is then increased to a higher but definite temperature and this time the methyl α-hydroxyisobutyrate is collected as a distillate on top of the ice, from above which it can be removed for examination.

There is no doubt, however, that in future we are likely to make much more use than hitherto of the vapour phase chromatographic method of examination of vacuum depolymerisation products and monomers. In this method we shall take advantage not only of the different volatilities of compounds and monomers, but also of their different distributions between stationary and carrier phase.

American Methods

We have always tried to get information about polymers, as I have indicated, by working *in vacuo* under controlled conditions. It is interesting, however, in this connection, to note how certain American chemists are working, notably Harms, Kruse and Wallace[11,12]. They take the view that many polymeric materials are pretty intractable substances and that it is difficult to obtain direct infra-red spectra of the substances in their original form. They argue that when a polymer is heated under specified and definite conditions, then the pyrolysis products will always be the same and always be in a definite ratio.

In practice Harms[11] tends to heat small fragments of the polymer in borosilicate glass tubes, using the flame of a Bunsen burner. The temperatures used are between 375° C and 750° C, depending on the type of sample which is suspected. He takes the pyrolysis product which condenses in the cooler parts of the glass tube and places this between two sodium chloride windows prior to determination of the infra-red spectrum.

The other authors[12] maintain the polymer at a more precise temperature of 830° F to 870° F and collect the resulting distillate in a known volume of carbon tetrachloride. The test has been applied, with some success, it is claimed, to such polymers as phenol-formaldehyde, urea-formaldehyde, 6 : 6 nylon, Saran (vinylidene chloride-vinyl chloride co-polymer), Terylene, Orlon (polyacrylonitrile), Dynel (co-polymer of vinyl chloride and acrylonitrile), Teflon (polytetrafluoroethylene), and silicone resins.

Then again other workers are looking at the problem from quite a different angle. They are seeking to get information about a polymer from the colour reaction of its volatile pyrolysis products, and I have certain evidence of recently published work along these lines[13].

Other Applications

Heating of polymers *in vacuo* often has other uses. We have made good use of this principle in quite another connection, i.e., in determining water in 6 : 6 nylon[14]. In this method the sample is heated under a vacuum of less than 4 mm. Hg in a test tube maintained in an aluminium block at 260° C for half an hour. The water evolved is collected in a U tube which is maintained at −80° C ; this is achieved by surrounding it with a 50 : 50 mixture of chloroform and carbon tetrachloride to which solid carbon dioxide is added. The U tube containing the condensate is washed out with dry alcohol, followed by determination of the water in the alcoholic extract by means of the Fischer reagent.

Another heating method of particular significance is that which we employ for the determination of free caprolactam in 6 polymer. Really this involves the vacuum sublimation on to a cold finger of the free caprolactam evolved on heating the sample at 240° C.

We make use of this heating principle in quite a different connection, when we volatilise the polymer completely and leave the residue we are interested in. Carbon black (of the order of 2 per cent) may be added to polythene to avoid decomposition or breakdown of the polythene by light. This proportion has to

be checked, but it may not be realised that the polythene may be volatilised by careful heating of the sample at 500° C in nitrogen. The residue of carbon black is weighed.

Because of the fact that I introduced this pyrolysis method in connection with work which I was describing on polymethyl methacrylate, it might not be out of place to say a few words about another problem always liable to concern the plastics analyst sooner or later, that of the proportion of residual monomer in a polymer. Polymethyl methacrylate, according to its method of preparation, may contain a small proportion of residual monomer. We have always obtained satisfaction by the application of a chemical method to this problem.

Determination of Monomer

We dissolve the polymer directly in the iodinating reagent, a solution of iodine monochloride in chloroform. We do not find it satisfactory to dissolve the sample in chloroform in the first place, and then to add the iodinating reagent. It is better to use the reagent itself to dissolve the polymer ; this maintains a very effective concentration of the iodinating reagent and, moreover, ensures iodination of the methyl methacrylate monomer immediately it is liberated. The rest of the procedure is conventional, consisting of addition of potassium iodide and titration of the liberated iodine with thiosulphate. The iodine used is calculated to monomer.

Alternatively, the proportion of monomer has been found by taking advantage of the fact that there is a band in the infra-red, at 1.65μ, which is characteristic of the $=CH_2$ groups of the monomer.

In this connection an interesting method has been put forward by Albertson and MacGregor[15] for the determination of monomer in partially polymerised acrylic and allyl esters. These authors give examples of the successful application of their method to monomer in polymethyl methacrylate and in polyisobutyl acrylate. Their method is restricted to those polymers soluble in pyridine. The pyridine solution of the polymer is added dropwise to bromide-bromate reagent in such a way as to produce a fine dispersion of the polymer. After acidification, and hence bromination of the monomer, carbon tetrachloride is added to dissolve the polymer, after which potassium iodide is added and the liberated iodine titrated with standard thiosulphate.

Other monomer determinations may be carried out by taking advantage of the different behaviour of monomer and polymer in the UV. Newell[16] has developed an interesting method along these lines for the determination of styrene in polystyrene. He takes advantage of the fact that at a wavelength of 251 mμ styrene has 100 times the absorption of polystyrene. He actually carries out the determination at 250 mμ, 255 mμ and 260 mμ. The figures, over the range 0.1 to 2 per cent of styrene in the polymer, should check at each wavelength, otherwise he is compelled to suspect the presence of some UV absorbing material other than styrene monomer in the polymer.

And now I would like to say a few words about the examination of polyvinyl chloride and related co-polymer compositions. These compositions are often quite complex because they may contain : the basic polymer or co-polymer ; a plasticiser or mixed plasticiser ; a stabiliser ; a pigment ; a lubricant ; a filler ; and residues of surface active agents.

In 1950 we published a paper[17] the main purpose of which was to help in solving the question most often asked in connection with these compositions : what is the nature of the constituent polymer ? I wish to pay particular attention to this because it illustrates a principle which is used over and over again in the analysis of plastic materials, solution of the polymer in one solvent followed by precipitation by a non-solvent. This may have one or other of two objects in view, the subsequent examination of the recovered polymer or of the additive remaining in solution.

PVC Compositions

In the case of polyvinyl chloride compositions, the plasticiser is first removed by extraction with ether and the polymer is then dissolved in tetrahydrofuran prior to centrifuging in order to free this solution from fillers, etc. The polymer in this tetrahydrofuran solution is then precipitated with alcohol, dried and reserved for chemical and spectroscopic tests. Useful chemical tests to apply are the morpholine test for polyvinylidene chloride[18] and the methanol pyridine alkali test for polyvinyl chloride[19]. Another extremely important test to apply to recovered polymers is the rapid determination of the chlorine content of the polymer.

In practice we fuse the polymer with sodium peroxide and catalyst in a stainless steel bomb and titrate the chloride in the slightly acid solution of the reaction product[20]. The point

I want to emphasise about this potentiometric titration is the simple electrode system which we use, a silver wire in contact with a weak solution of silver ions as a source of constant potential, and a silver wire in contact with the solution under test as a source of variable potential.

During recent months we have had the opportunity of examining an automatic titrimeter and have shown that it is possible to manipulate the instrument in such a way that the chloride titration is still further improved, since we proceed quickly to the end-point in known and unknown samples automatically and overshooting of the end-point is avoided. Within one hour of receipt of the sample the chlorine content of an organic sample may be obtained correct to ± 0.1 to 0.2 per cent in 50 per cent[21].

We use the solvent/non-solvent principle in other connections, as in the determination of dibutyl phthalate plasticiser in polymethyl methacrylate[22]. This involves solution of the sample in acetone followed by precipitation of the polymer with petroleum ether. The polymer is filtered off and the plasticiser recovered from the filtrate. Another application is in the determination of UV absorbers in Perspex[23] and in polyvinyl chloride. We are concerned with the determination of such substances as phenyl salicylate, methyl salicylate, 2 : 4-dihydroxybenzophenone, stilbene and resorcinol monobenzoate in acrylic polymers.

General Principles

The general method of attack is first to release the absorber by solution of the sample in acetone followed by precipitation of the polymer with alcohol. We search for the particular absorber in the acetone/alcohol solution by both chemical and spectroscopic procedures.

The chemical procedure involves preliminary hydrolysis of the esters and subsequent application of such tests as Millon's test, the indophenol test with 2 : 6 dibromoquinone-chlorimide, and the ferric chloride test. On the spectroscopic side we make good use of the UV absorption of the particular UV absorber, e.g. of phenyl salicylate at 312 mμ.

A further use of the solvent/non-solvent principle is in the determination of catechol in nylon. In this case we release the catechol by hydrolysis of the nylon with hydrochloric acid in a sealed tube. Chemically the catechol is determined by applying the ferric chloride test (alongside known standards) to the hydrolysis products. Spectroscopically, the result is checked by taking advantage of the UV absorption of the catechol at 275 mμ.

Finally, it is desired, on occasion, to know something of the free phenols and cresols in a phenol-formaldehyde or phenol-cresol-formaldehyde resin[24]. The sample is dissolved in alkali, and the resin precipitated at *p*H 4.5, and subsequently filtered off. In that way the free phenols are released and may be determined in the filtrate. A measure of the total phenols is obtained by bromination and the phenols are determined in the presence of the cresols by the application of Millon's test. Phenols give a red colouration with Millon's reagent whereas the cresols do not. Incidentally, Smith, Rugg and Bowman[25] claim to be able to determine the free phenol content of phenol-formaldehyde resins by an infra-red method. This is based on the absorption due to the phenol at 14.4 μ of an acetone solution of the resin sample. The method is said to be accurate to ± 0.3 per cent.

Urea-Formaldehyde Ratio

And now I would like to describe a method which was developed by Grad and Dunn for the determination of the ratio of urea to formaldehyde in urea-formaldehyde condensation products[26]. After modification we have found this method exceedingly satisfactory.

As we apply the method the condensation product is distilled with 1 : 1 phosphoric acid solution and the distillate is collected in alkaline potassium cyanide solution, forming the cyanohydrin. The liquid in the distillation flask is maintained at 110° C throughout by controlling the addition of fresh phosphoric acid solution. At the conclusion of the distillation an aliquot of the distillate is added to an acid solution of silver nitrate, when the cyanide not used up by the formaldehyde is precipitated as silver cyanide The acid solution is now adjusted to the correct acidity prior to potentiometric back titration of the excess silver with standard sodium chloride solution. We get great satisfaction from this method and avoid the rather lengthy gravimetric finish as silver cyanide.

The urea determination is based on its liberation from the resin and conversion to dibenzyl urea by its reaction with benzylamine ; this procedure was originally developed by Kappelmeier[27]. Following the original description by Grad and Dunn, we did not get

complete satisfaction on application of the test. We found it desirable to heat in an open tube in such a way that any water produced is boiled off but the benzylamine condenses about half-way up the tube. We like to carry out the reaction with benzylamine for definite periods of time, e.g., 2 hours and 4 hours, because that enables us to get some idea of the degree of cure of the resin. Lightly condensed resins will yield up all their constituent urea in 2 hours. After this period the reaction product is cooled to about 40° C and excess hydrochloric acid added. Cooling in ice now produces fine crystals of dibenzyl urea which are filtered off, washed and dried.

In miscellaneous work on moulding powders and urea condensation products of all kinds we do not accept this residue as being dibenzyl urea alone ; it may contain fillers. For this reason we prefer to carry out a Kjeldahl nitrogen determination on the product and relate this to dibenzyl urea and hence to urea.

Coatings on Paper & Fibres

Analysts in the plastics industry sooner or later come up against problems connected with the identification of coatings on such materials as paper and fibres. It is, therefore, necessary to watch carefully sources of information such as the *Paper Trades Journal*, the *Journal of the Textile Institute*, publications of the Shirley Institute, the *Melliand Textilberichte* and *Kunstoffe*, as well as PATRA publications, for useful tests.

One of the more useful tests of which we have had experience is that of Widmer[28] for the identification of urea formaldehyde and melamine formaldehyde in wet strength paper. The principle of the urea identification lies in the breakdown of the sample with acetic acid solution, followed by isolation of the urea as its xanthydrol derivative, which is crystallised from hot pyridine in characteristic form. For melamine, the sample is broken down as before and the acetic acid extract evaporated to dryness. The melamine in the residue is sublimed at 300° C in an evacuated sealed tube prior to identification (a) as characteristic crystals of melamine itself by crystallisation from water and (b) as the picrate.

In the period I have been dealing with there have been quite important improvements in connection with other polymers, such as the determination of fluorine in polytetrafluoroethylene[29].

Now we must turn to the examination of plasticisers, a problem connected in many ways with a great number of polymeric compositions. Judging from the enquiries we have had from all parts of the globe, Willis, Soppet and myself[30] did make some small contribution to this problem in trying to bring together the chemical and infra-red examination of individual and mixed plasticisers.

On the chemical side we drew attention to the great importance of tests for elements, of the usefulness and limitations of tests for phthalate, of the 2 : 6-dibromoquinonechlorimide tests for phenolic and cresylic plasticisers, and of fluorescence tests. Similarly, on the quantitative side we dealt with such determinations as that of phosphate, chlorine, saponification value and phthalate, paying particular attention in the latter case to the interference of Cerechlor and the ways of overcoming this.

More important, however, were the methods devised both on the macro and semi-micro scale for the examination of the alcoholic constituents of ester type plasticisers, whilst some attention was paid to the separation of cresols from plasticisers containing phosphate. On the infra-red side the paper includes 22 spectra of individual plasticisers and some useful information on the identification of mixed plasticisers.

Phthalate Esters

In my view an exceedingly useful test for phthalate esters in commercial plasticisers has been put forward by two American investigators, Whitnack & Gantz[31]. In ordinary work we have always used both resorcinol-phthalein and phenolphthalein tests for the qualitative detection of phthalates in plasticisers. It should be realised, however, that in certain circumstances this test may fail completely, e.g., in the presence of castor oil, due to excessive carbonisation.

It may not be known, however, that qualitative evidence of the presence of a phthalate plasticiser may readily be obtained in similar circumstances by simple polarographic tests. Quite small amounts of phthalate ester, e.g., 2 per cent, may be readily detected by applying the polarographic test to a mixture of 0.1 g. of the plasticiser and 2.5 ml. of 0.1M tetramethylammonium iodide, diluted to 10 ml. with methyl alcohol. After removal of oxygen the solution is polarographed over the range −1.0 to −2.0 volts. In the presence of the dibutyl ester the reduction occurs at

about −1.45 volts. It is interesting to note that such substances as tricresyl phosphate, butyl acetyl ricinoleate, tributyl citrate, triethyl citrate, dibutyl sebacate, Cerechlor, Mesamoll and castor oil do not interfere under the conditions of the polarographic test.

Finally, I would like to draw attention to a few miscellaneous papers of which I have some experience which have enabled us to make interesting developments in polymer work.

Sooner or later the analyst in the plastics industry becomes interested in surface active agents ; they are often used in polymerisation processes and at other times as constituents of such materials as spin finishes. The paper by Gilby & Hodgson[32] is useful in identification work, as is the publication of the Society for Analytical Chemistry[33]. In my experience, however, far and away the most practical piece of work is that of Wurzschmitt[34], a really excellent piece of work.

The analyst may come up against problems connected with the examination of plywood glues and in the identification of glue lines in bonded plywood. He will find the work of Franklin & Rendle[35] invaluable in this connection.

In connection with the identification of thiourea-formaldehyde resins, useful adaptations may be made of the work of Fearon[36].

Further, it may not be realised that Easterbrook and Hamilton's[37] method of determination of alkoxyl values may readily be applied to the determination of polymethyl methacrylate in polymethyl methacrylate-methacrylic acid interpolymers.

Bromine & Iodine

It is unlikely that the analyst in the plastics field will fail to encounter problems involving the determination of bromine and iodine in organic polymers. We have often made use of our own experience in this field in bromine determinations[38], as in 4-vinyl pyridinium bromide. Where bromine and iodine and possibly chlorine are involved, the work of D'Ans & Kanakowsky[39] has been very useful.

I should like to draw attention to the work of Kolthoff[40] which, in our hands, has proved to be very valuable in determining the proportion of nitrogenous compounds such as gelatin in polyvinyl chloride.

In conclusion there are one or two pieces of work to which reference might be made, for example the determination of fillers in phenol formaldehyde mouldings, which will form the subject of a note in the literature ; a note on the rapid determination of free formaldehyde in phenol formaldehyde syrups[41] ; the determination of added hexamethylenetetramine in two-stage phenol formaldehyde resins[42] ; the determination of *o*-tolyl ester in tritolyl phosphate [43] ; and the determination of rye flour in UF syrups[44].

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Leather Chemists' Topics

Ion Exchange & Fats

A MEETING of the Manchester Group of the Society of Leather Trades' Chemists was held in Manchester on 4 December, when two papers were read and discussed.

The first, by Dr. K. W. Pepper, was entitled 'Ion-Exchange Resins.' Ion-exchange resins can be regarded as insoluble acids or bases, the salts of which are also insoluble. With the improved and well-defined resins now available, the following generalisations may be made: (a) ion-exchange reactions are strictly stoichiometric, although the equivalence of exchange may be obscured by other phenomena; (b) ion-exchange reactions are reversible and there is no hysteresis; (c) all the acidic (or basic) groups in an exchange-resin are accessible as exchange-sites for small ions, and the total exchange-capacity (expressed in gram-equivalents) is the same for all small ions and independent of particle size.

Chemical Structure

From the view-point of chemical structure, ion-exchangers consist of a cross-linked, three-dimensional framework to which ionised or ionisable groups are attached. The polymeric framework plays an important part in determining ion-exchange behaviour but the dominant influence is the nature of the ionisable groups. Cation-exchange resins contain acidic groups which may be strongly acidic, such as sulphonic acid groups, or weakly acidic, such as carboxylic acid groups. Anion-exchangers contain basic groups which again may be either strongly basic (quaternary ammonium) or weakly basic (aliphatic or aromatic amines).

An account was given of the behaviour of these four main types of resin with respect to *p*H changes, stability of salts, ease of regeneration, and rates of exchange. It was noted that the characteristic properties of the ionisable groups in simple compounds are reproduced when they are incorporated in resins.

The most important industrial application of ion-exchange is in water-treatment—either complete deionisation or simple water-softening. Other industrial applications include the conservation of pickle acids; the recovery of metals, e.g. copper and gold; the purification of organic compounds, e.g. methanol, glycerol and commercial formalin.

The second paper was given by G. F. Robertshaw on 'The Interesting Story of Oils & Fats.' The lecture opened with brief notes on the history and economics of the subject, followed by discussions on vegetable oils and their uses; the preparation of oils and fats; the constitution and properties of fatty acids; the constitution, physical structure and properties of glycerides; and other interesting topics.

DDT Claims Considered

THE Royal Commission on Awards to Inventors began an inquiry in London on 13 December, to decide claims by J. R. Geigy SA of Basle, and T. Geigy Co. Ltd. of Manchester, in connection with the use of DDT as an insecticide. It was stated that the patents for DDT were shared by the two firms. In 1932 the Geigy Co. began work with the object of discovering an anti-moth specific. Some four years later Dr. Muller began research for a specific against the Colorado beetle, and in 1939 was successful in producing DDT.

In 1942 it was made clear that the insecticide was extraordinarily effective against lice and mosquitoes; reports on infestation for the first five weeks after the landing in France indicated that the weekly infestation was as low as 0.6 in 100,000. 'For every lousy British soldier there were 8,000 lousy German soldiers. . . .'

Exemptions from KID

THE Treasury has made an Order under Section 10 (5) of the Finance Act, 1926, exempting the following articles from Key Industry Duty, for the period December 9, 1954, to February 18, 1955:—

Photographic process screens of the contact type, not exceeding 25 in. in overall length or breadth, and consisting of a grey-dyed base of cellulose acetate on which is a regularly spaced pattern of dots with 60, 120, 133, 150 or 300 'lines' to the inch.

α-Aminodiphenylmethane hydrochloride barium hydroxide; *o*-phenetidine; 2:4:5-trichlorophenol.

This Order is the Safeguarding of Industries (Exemption) (No. 11) Order, 1954, and is published as Statutory Instruments 1954. No. 1609. Copies may be obtained (price 2d. net, by post 3½d.) from HM Stationery Office, Kingsway, London W.C.2, and branches, or through any bookseller.

Carbon Determination in Metals

New Conductimetric Method

THERE has been a demand in recent years for the accurate determination of very low carbon contents in certain ferrous materials used for electrical purposes. In iron-silicon alloys for example, the hysteresis losses increase rapidly with increasing carbon content and a maximum of 0.05 per cent is permissible. Similarly with pure iron, interesting and useful magnetic properties are obtained with less than 0.01 per cent carbon. The determination of carbon in these materials calls for an accuracy of at least three places of decimals, and the two techniques in fairly common use for the determination of very low carbon contents both have certain disadvantages.

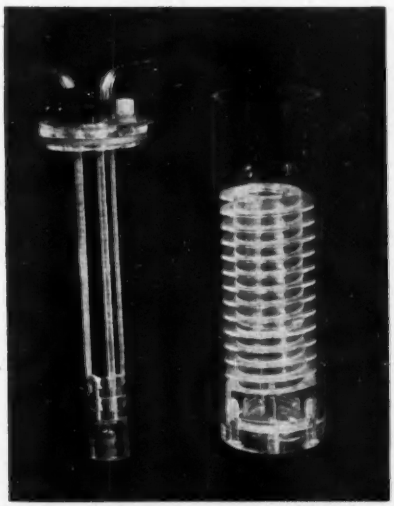
One of these techniques, the 'low pressure' method, relies on the condensation in a liquid oxygen trap of the carbon dioxide formed by combustion of the carbon in the sample. The gas is then expanded into an evacuated vessel of known volume and its pressure measured. This is a fairly rapid and accurate method but is complicated and inconvenient for occasional use.

The second method uses the normal process whereby the carbon dioxide produced in combustion is absorbed and weighed, but the extra sensitivity required is obtained by an increase in sample size. Such large samples (of 10 to 20 g.) are easily obtained in a steel works but are seldom available in research investigations.

A third method, which has been less commonly used, involves the electrical conductimetric determination of the carbon dioxide produced in the combustion of a sample of normal size (1 or 2 g.). This method has recently been further developed in the research laboratories of The General Electric Co. Ltd. and, after a number of modifications, has been found to fulfil all the present requirements.

Purified oxygen is supplied at a controlled rate to a mullite combustion tube containing the specimen in an aluminous porcelain boat. The combustion tube temperature varies between 1,100° and 1,300° C, depending on the material to be analysed. A special loading device permits the boat to be pushed into the hot zone of the furnace, without the entry of air, after the combustion tube has been swept out with pure oxygen. The gases leaving the combustion tube are passed through granular manganese dioxide to remove oxides of sulphur and thence into the specially designed Perspex conductivity cell (see illustration). This contains a solution of caustic soda or barium hydroxide at a thermostatically controlled temperature, together with a trace of a non-ionic wetting agent.

The gas bubbles formed are made to follow a helical path about 55 inches in length, which ensures efficient absorption of the carbon dioxide. The solution circulates to the electrode chamber in the centre of the cell and the conductivity is determined by means of a Wheatstone bridge circuit using a 50c AC supply and a vibration galvanometer for null indication. A major virtue of this method of determining carbon content is that the conductivity can be measured at any moment without stopping



The Perspex conductivity cell designed by the GEC Research Laboratories. Left: lid and central portion showing platinum electrodes and gas passages. Right: body and base of cell, incorporating helical gas bubble passage

the flow of oxygen. This enables the operator to be perfectly sure when evolution of carbon dioxide ceases.

The measuring cell itself contains only 45 ml. of solution, which gives high sensitivity, and is robust and very easily emptied and refilled. The conductimetric method also has the advantage of wide range, so that high-carbon cast irons can also be analysed.

Combustion of cast irons, iron powders, and plain carbon steels is complete and sufficiently rapid, without the use of fluxing or igniting materials. With all other alloys so far analysed, either lead or tin or both these metals have been found to be useful additives which do not introduce large errors. Lead is useful for iron-rich alloys and acts primarily as a flux. Tin acts mainly as an igniter and is most useful for alloys containing large amounts of nickel, cobalt or tungsten; with high-nickel alloys tin has an additional fluxing effect.

The results shown in the following table were obtained on two standard steels and one standard cast iron from the Bureau of Analysed Samples Ltd.

Carbon present according to BAS		Carbon determined by Conductimetric Method per cent	
Average per cent	Range per cent		
0.029	0.0275 to 0.032	0.0289	0.0283
		0.0283	0.285
0.365	0.360 to 0.370	0.361	0.363
		0.363	0.362
2.88	2.83 to 2.93	2.90	2.89
		2.88	2.89

These determinations were made on 0.5g. and 1.0g. samples with caustic soda solution in the cell. No result has been discarded. On low-carbon samples containing 0.01 per cent carbon duplicate analyses agree within 0.001 per cent and usually between 0.0002 or 0.0003 per cent.

Sample weights have varied from 0.1g. to 3g. and close agreement has always been obtained when results have been checked by independent gravimetric determinations.

Courses Next Year

THREE special courses, each of ten lectures, will start at the Borough Polytechnic, Borough Road, London S.E.1, in January. They will deal with 'Human Nutrition—Energy Requirements,' 'Surface Chemistry and Colloids' (with special reference to detergent solutions) and 'Surface Active Agents.'

Lectures in the nutrition course will be held on Mondays from 17 January to 21 March at 6.30 p.m. They will include a consideration of energy requirements in health and disease, problems of starvation and under-nutrition and techniques of nutritional surveys. Lecturers will include Dr. O. G. Edholme, of the Human Physiology Unit, Medical Research Council, Dr. J. N. Hunt, of the Department of Applied Physiology, Guy's Hospital Medical School, Dr. H. E. Magee and Dr. W. J. Berry, of the Nutrition Division, Ministry of Health.

The course on surface chemistry and colloids will be held on Wednesdays, 19 January to 23 March, at 7.30 p.m. Lectures will be given by Dr. K. G. Pankhurst and will deal with physico-chemical aspects of colloidal systems including surface films, emulsions and foams, catalysis, colloidal electrolytes, wetting and detergency.

A panel of lecturers will deal with the organic chemistry and industrial production of the anionic, cationic and non-ionic surface active substances. This course will also be held on Wednesdays, at 6 p.m.

Further information is obtainable from Dr. F. Aylward, Head of the Department of Chemistry and Food Technology, Borough Polytechnic.

Desiccants for Packages

TWO new standards recently published by the British Standards Institution are 'Silica Gel for use as Desiccant for Packages' (BS.2540: 1954) and 'Activated Alumina for Use as a Desiccant for Packages' (BS.2541: 1954.) While the grade of desiccant described in these standards may find application for uses other than packaging, the limits for dust, *p*H reaction and ammonia and ammonium compounds have been specified with the object of affording protection to the contents of packages against risk of corrosion caused by fine particles of the desiccant leaking from their containing envelope into the bulk of the package.

A code for the use of these materials has already been published under the authority of the Packaging Standards Committee as BS.1133, Section 19.

BS.2540 and BS.2541 are available from the Sales Branch of the Institution, 2 Park Street, W.1, price 2s. 6d. each.

Odoriferous Content of Vegetable Oils*

by PIERRE MÉRAT, Director of Research & Instruction
(Institut Technique et de Recherches des Corps Gras, Paris)

IN addition to their content of mixed unsaturated triglycerides, the raw vegetable oils also include other components. Because these are no glycerides the oil extractors refer to them as impurities ; however, instead of implying an inferior quality to these substances it would be better to call them 'minor components.'

Some of these substances, usually called 'mucilages,' are phosphoamino lipids ; others are free fatty acids. A third group of natural oil components includes pigments, xanthophylls, chlorophylls, carotenoids, sterols, tocopherols carbon, compounds such as squalene and, finally, odoriferous oils.

Each of these categories can be separated in the course of the refining procedures which are employed to make the product suitable for alimentary and industrial utilisation. Thus, the lecithins and other components held in colloidal suspension are eliminated by removal of the mucilages ; the free fatty acids are neutralised, the pigments bleached and the aromatic substances eliminated by deodorisation.

The Final Operation

This odour-eliminating operation, which concludes the refining procedures, consists in blowing wet steam through the oil under reduced pressure, and may be carried out in a continuous or discontinuous cycle. The process is based on the wide difference between the volatilities of the odoriferous oils on the one hand, and, on the other, of the glycerides, which are not distilled by the steam under practical operating conditions.

Because the odoriferous components of raw oils are only a tiny fraction, they are of minor—though in no way negligible—importance to the extractors. They are variable and complex mixtures and have scarcely been studied so far. French researches in this sphere have followed up the initiative which some British chemists took a few years ago.

The first French specialists to take up the subject were Haller and Lassieur, who showed that the deodorisation distillates of coconut oil include ketones, carbinols, and traces of an unknown aldehyde. In 1936, Marcelet, in a short note published in the *Comptes Rendus* of the French Académie des Sciences, described some unsaturated compounds which he had isolated from the deodorisation distillates of olive and peanut oil, among them $C_{13}H_{24}$, a dienic compound which possessed a pleasant aromatic odour. The other chemicals detected were almost, or completely, odourless. From peanut oil he extracted a compound corresponding to the formula $C_{18}H_{30}$ and another one, $C_{19}H_{38}$, which were rather unpleasant in odour. The ratio of aromatic chemicals in the oils is very low ; about 0.8 per cent of the original oil in olive, and 0.2 per cent in peanut oil.

Other Isolates

About the same time a Japanese chemist, Nakamiya, detected a substance which he called gadusene and which corresponded to the formula $C_{18}H_{32}$, in the deodorisation distillates of soybean oil. Other compounds were isolated from cocoa butter, and squalene was found in the deodorisation distillates of a large number of vegetable oils.

The British authors Jasperson and Jones took up the matter in 1947 and examined the deodorisation distillates of six oils : coprah, dwarf fan-palm, palm, peanut, cotton, and sunflower.

In order to extract the unsaponifiable matter from the deodorisation distillates, Jasperson and Jones treated them with a 5-10 per cent alcoholic solution of potassium under reflux for four hours. After the alcohol had been distilled off, continuous ether extraction was employed with agitation and the use of an inert gas, as originally described by Holt and Kallow. From the etheral layer a small quantity of calcium soap was recovered, which was probably due to the hardness of the water used in the preceding step. The last traces of calcium soap were eliminated by washing with hydrochloric acid, water, soda solution, and again water, until neutralisation was achieved. The solution was dried over anhydrous soda and the solvent distilled off under reduced pressure. The general characteristics of the

*Originally published in *La Parfumerie Moderne*, 43, [23], and translated from the French by M. Neurath by kind permission of the author and editor.

distillates recovered are indicated in Table 1.

TABLE 1

Unsaponifiable Extracts of Deodorisation Distillates

	Spec. Weight	Refractory Index	Iodine Index (Wijs)	Per cent of original oil
Coprah ..	0.8592	1.4565	25.3	0.036
Dwarf Fan-Palm	0.8527	1.4460	22.7	0.04
Palm ..	0.8900	1.4900	134.5	0.04
Peanut ..	0.8954	1.4961	56.4	0.037
Cotton ..	0.8892	1.4903	59.8	0.037
Sunflower ..	0.8999	1.4919	118	0.022

The degree of saturation of these distillates differs greatly. The percentage recovered in relation to the original oil is low, but should not exclude commercial utilisation.

In order to get a general idea of the extracts recovered, these were fractionated under reduced pressure, which resulted in partial separation and provided the starting point for a more detailed analysis. Fractionation was achieved under 0.1 mm. Hg. The analysis of the fractions produced was directed towards detection of the following :

1. Ketones—by the method of Reclaire and Franck.
2. Hydroxyl groups—by the closed tube method of Petersen and co-workers.
3. Hydrocarbons—by elementary analysis.

Through these first and somewhat crude analyses, ketones were detected in the low-boiling fractions of all distillates. Sometimes these were found accompanied by the corresponding carbinols. In the higher boiling fractions which have a darker colour in the vicinity of orange, hydrocarbons were detected and, apart from the case of specific oils such as peanut, small quantities of hydroxyl groups were present. The final fractions, which were dark and viscous, contained chemicals which acted as powerful oxidation inhibitors. In the extracts of peanut oil this was a pronounced feature. In distillates recovered from palm, sunflower, cotton and peanut oil, the hydrocarbons were found to be predominant and the ketones not in excess of 2 per cent. However, in distillates of dwarf fan-palm and coprah oil the ketones were at a concentration of 50-65 per cent.

TABLE 2

Ketones and Carbinols in the Deodorisation Distillates

	%		%
Methyl heptyl ketones		*Methyl heptyl carbinol*	
Coprah	traces	Coprah	7
Methyl nonyl ketones		*Methyl nonyl carbinol*	
Dwarf Fan-Palm	63	Dwarf Fan-Palm	5
Coprah	47	Coprah	10
Palm	2.0	Peanut	traces
Peanut	0.3	Sunflower ..	traces
Cotton	0.6	Cotton	traces
Sunflower ..	1.6		
Methyl undecyl ketone			
Dwarf Fan-Palm	1		
Coprah	3		

*% of unsaponifiable matter

Separation of ketones and carbinols was effected by converting the ketones into semi-carbazones which were subsequently fractionally recrystallised from absolute alcohol. The carbinols left after the ketones had been eliminated were oxidised into ketones, which were identified as indicated above. Table 2 illustrates the percentages of compounds isolated.

It will be seen that the methyl nonyl ketone predominates in dwarf fan-palm and coprah, along with small quantities of methyl undecyl ketone in the same distillates and traces of methyl heptyl ketone in the case of coprah. Methyl nonyl carbinol is present at a concentration of 5 per cent in the distillate of dwarf fan-palm oil and of 10 per cent in the extract of coprah. Traces of methyl nonyl carbinol exist in peanut distillate, but have never been found in cotton and sunflower derivatives.

Solid substances have only been isolated in palm and sunflower oil. They occur at a rate of about 20 per cent of the distillate of palm, and 10 per cent of sunflower oil. These are ternary compounds of a complex nature of which the empirical formulae are $C_{13}H_{37}O$ and $C_{52}H_{104}O$. Table 3 indicates some properties of these components.

TABLE 3

Solid Matter in the Unsaponifiable Fraction (Distillates of Palm Oil and Sunflower Oil)

	Formula	Per cent of Unsaponifiable Fraction	Melting Point	Iodine Index (Wijs)
Palm ..	$C_{17}H_{34}O$	10	55.5°C	36.7
	$C_{80}H_{38}O$	3	59.5°C	—
	$C_{52}H_{104}O$	6	52.5°C	39.2
Sunflower	$C_{13}H_{26}O$	10	60.5°C	6.6

Carbon and hydrogen analyses made on liquid hydrocarbons and determinations of their iodine index have shown that they are complex mixtures. By treatment with boiling methanol two fractions were nevertheless separated, one soluble in methanol and mostly formed of terpenic compounds, and another which proved insoluble in methanol and consisted mainly of aliphatic substances. Tables 4 and 5 indicate the ratio of carbon atoms in the cases studied.

These tables show that the hydrocarbon ratios are worth consideration. By examination of the absorption spectra it is easy to distinguish between terpenic and aliphatic carbon compounds.

The details referred to here were first published by Jasperson & Jones in a more

TABLE 4

Terpenic Hydrocarbons in the Distillates

	Formula	Per cent of Unsaponifiable Matter
Coprah	$C_{30}H_{50}$	5
	$C_{30}H_{48}$	3
Dwarf Fan-Palm	$C_{30}H_{48}$	5
Palm	$C_{30}H_{50}$	28
	$C_{30}H_{48}$	10
	$C_{30}H_{46}$	12
Peanut	$C_{30}H_{50}$	15
	$C_{30}H_{48}$	15
Cotton	$C_{30}H_{50}$	13
	$C_{30}H_{48}$	30
Sunflower	$C_{30}H_{48}$	45

TABLE 5

Aliphatic Hydrocarbons in the Distillates

	Formula	Per cent of Unsaponifiable Matter
Coprah	$C_{25}H_{52}$	5
	$C_{25}H_{54}$	4
Dwarf Fan-Palm	$C_{29}H_{58}$	5
Palm	$C_{31}H_{64}$	4
	$C_{29}H_{58}$	4
Peanut	$C_{29}H_{58}$	19
	$C_{27}H_{54}$	20
	$C_{25}H_{52}$	8
	$C_{40}H_{68}$	4
Cotton	$C_{16}H_{30}$	10
	$C_{29}H_{58}$	11
	$C_{29}H_{59}$	3
Sunflower	$C_{29}H_{58}$	10
	$C_{28}H_{56}$	6

detailed paper. It is quite possible that the pronounced odour and flavour which Marcelet noted in the deodorisation distillate of peanut oil are due to a contamination with terpenic substances. On the other hand studies on olive oil, as conducted by Fitelson, justify the assumption that this oil includes far more squalene than do the other vegetable oils.

In the first part of this paper, reference was made to the work of Haller & Lassieur, who detected an unknown aldehyde in the deodorisation distillates of coprah oil. An American chemical journal made a new contribution to this subject in Sept. 1950 ; according to this source, the so-called coprah aldehyde is actually based on α-nona-lactone, which has proved suitable for use in perfume products, either as a base or in admixture with other aromatics. It is essential as a raw material in prune and apricot perfumes and available to the trade under the names of cocolide, prunolide, and apricotine.

TABLE 6

Approximate Ratio of Specific Components in Relation to the Original Oil

	Per cent Terpenes	Per cent Aliphatic compds.	Per cent Methyl ketones	Per cent Methyl carbinols
Coprah ..	0.004	0.004	0.02	0.006
Dwarf Fan-Palm	0.004	0.004	0.026	0.002
Palm ..	0.025	0.007	0.0008	
Peanut ..	0.019	0.013	0.0004	
Cotton ..	0.025	0.01	0.0002	
Sunflower	0.0135	0.0045	0.0001	

The author has tried to indicate the odoriferous components in vegetable oils which might serve as perfume bases and additives to cosmetics. If the rate at which they occur in specific oils is too low to make the extractors take an active interest in their recovery, their extraction should, nevertheless, be visualised in other cases where it would pay ; and particularly so in the case of the lauric oils. The next step to take is to determine the practical technique of extraction and purification. This problem has been partially solved already in France, under the direction of the Institut des Corps Gras. It is hoped that the studies now under way will achieve practical results in every respect, and permit the commercial utilisation of these aromatic products.

Reservoir's Rubber Bag

TWO extensive tests carried out after six and nine months' service on the huge rubber bag which holds 12,000,000 gallons of water in one of the two Mill Hill reservoirs at Easington, near Sunderland, Durham, have proved that the experiment of using rubber lining in service reservoirs is a success.

In a paper read to the Institution of Water Engineers in London on 3 December Mr. A. G. McLellan, chief engineer and general manager of the Sunderland and South Shields Water Company, which owns the reservoirs, told how the use of rubber lining was the outcome of a process of evolution over a number of years.

The actual lining of the reservoir, done by Dunlop, lasted only 20 weeks, he said, and was finished on 31 December last. Mining subsidences, he explained, had caused heavy leakages and reduced the total capacity of the two reservoirs from 24,000,000 gallons to 3,000,000 gallons. In filling the cracks concrete groutings and bitumen sheeting had proved unsatisfactory and the method finally adopted was the fabrication of a large rubber bag pegged to the walls and freely resting on the floor.

The total weight of the rubber lining, he added, was 100 tons, and the total cost £67,960, against an estimated cost of over £200,000 of building a new reservoir. A conservative estimate of the life of the rubber was 20 years, but he confidently believed it would have a very much longer life. The total area of the lining was 14,660 sq. yds.

British Association of Chemists AGM

New Membership Grade Approved

THE 37th annual general meeting of the British Association of Chemists was held at the Waldorf Hotel, Aldwych, London W.C.2, on 11 December, Mr. F. Scholefield, M.Sc., F.R.I.C. (President), in the chair.

The annual report of the council for 1953/54 stated that the most interesting event of the year was the decision, taken at a special general meeting, to amend the rules so as to allow for a new grade of membership. These members were to be described as 'Chemical Technician Members' and the grade had been instituted to provide for those not qualified for associate membership and who were ineligible for student membership. A large number of men performing important functions in the chemical industry had not been eligible for admission to the association, as they had not the necessary educational qualifications. It was felt that the BAC could not claim to be representative of the chemical profession as a whole if that large and important group were excluded. The members of the new grade were entitled to the same services as those available to members and associates, but their voting power and eligibility for holding office in the association were restricted. In addition, when their numbers exceeded 100, the grade was to become self-supporting as regards unemployment benefit. There would be, however, a contribution from the accumulated funds for that purpose up to a maximum of £3,000 if it became necessary.

Increased Membership

New members elected during the year numbered 129, as against 99 during the previous year, it was reported. Three members had applied for re-instatement. There had been resignations of 34 members, and 19 had died. The promotion of nine student members, four chemical technicians and two associates to higher grades of membership was approved during the year.

During the year two members had, with the aid of the association's legal department, obtained adequate compensation, although in each case the employers had sought to terminate their appointments with one week's notice. Free legal advice was given to 22 other members.

The council appointed Mr. G. R. Langdale, A.C.A., to be General Secretary of the Association as from 1 October, 1954. Mr. H. Feldon Baker, F.C.A., ceased to act as secretary accountant after 30 September, 1954. At a later stage of the meeting, Mr. Baker was presented with a cheque as a token of the Association's appreciation.

An increase of the basic unemployment rate to be paid during 1954/55, as recommended by the Unemployment Committee, was approved by the meeting, as follows:—

An amount of 2s. 6d. per unit per week for each unit held for more than two years, and where the member has not been in arrears with his dues during the two years preceding the date of commencement of unemployment.

A further amount of 2s. 6d. per unit per week for each unit held for more than five years, and where the member has not been in arrears with his dues during the five years preceding the date of commencement of unemployment.

The Hinchley Medal for the current year was awarded to Dr. P. Haas, for his work on behalf of the association.

IN THE EDITOR'S POST

Industry v. Pests

SIR,—I read with considerable interest, only recently, your leader in the number dated 16 October, 1954, and although I must apologise for being so late with my remarks, I was very intrigued that in this year of grace 1954, an article can be written on 'Industry v. Pests' without a single mention of DDT.

Yours faithfully,
GEO. A. CAMPBELL.

Bramhall, Cheshire.

Editor's Note: No discrimination against DDT was intended as none of the more recently developed insecticides (such as BHC, dinex, DNC, heptachlor, aldrin or dieldrin) were mentioned. Our article was concerned only with the early history of the British pesticides industry.

HOME

Shell Reduces MIBK Prices

A reduction in price of methyl isobutyl ketone by £4 per ton has been announced by Shell Chemicals Ltd. Users are said to be finding MIBK increasingly attractive on a price/performance basis.

British Plastics Export Record

The British plastics industry is already assured of a record export year in 1954 for plastics materials. Exports for the first ten months of the year amounted to nearly £17,500,000, which is already nearly £1,000,000 more than the value (over £16,500,000) for the whole of last year, when exports reached their previous highest level. The material exports include such items as moulding powders, resins, sheet, tube, rod and foil, but exclude manufactured articles and parts.

November Steel Production

Steel production in November reached a new high level averaging 377,000 tons a week. This exceeds the previous highest output of 374,500 tons a week which was achieved in both May and October this year. Pig iron production in November, which averaged 235,300 tons a week, was also higher than in any previous month.

Outlook Encouraging

In a report on the British petroleum equipment industry *The Financial Times* says it has renewed its progress after a setback last year caused mainly by the fulfilment of several major refinery projects in this country and abroad, and long term prospects are encouraging. The gap between British and US equipment, it is said, both as regards the range offered and its technical quality is steadily narrowing, and in some cases British practice is believed to be somewhat ahead of that in America.

Copper Production

UK refined copper production during October amounted to 9,282 long tons (primary) and 8,816 long tons (secondary). Imports were 14,362 long tons, and in addition 5,235 long tons of blister copper were imported, mostly from British countries. Consumption during the month was 9,556 long tons of blister copper and 40,664 long tons of refined copper.

More Man-Made Fibres Used

Industrial uses of man-made fibres have increased considerably this year, according to *The Financial Times*. More than 30 per cent of total deliveries of rayon yarn and nylon are now accounted for in this way, and the demand continues to increase. Largest users are tyre manufacturers, but increasing quantities of high tenacity yarn are going into conveyor belts, especially for the coal industry.

Research Scholarship

The University Court of Glasgow has accepted an offer to provide a postgraduate scholarship in chemical research made by the Aliphatic Research Company, a research organisation jointly sponsored by the W. G. Hardesty (Chemical) Company of America and the Geigy Co. Ltd. of Manchester.

Fertilisers May Cost More

The Fertiliser Manufacturers' Association have issued a warning that prices of certain fertilisers may have to be increased soon because of the large increase in sea freight rates in recent months. Sea freight rates are an important part of the cost of the raw materials for superphosphate, triple superphosphate and ground phosphate rock. Compound fertilisers containing these products may also go up in price. (See THE CHEMICAL AGE, 1954, **71**, 1237.)

40,000 Buyers at Scots Exhibition

The 1954 Scottish Industries Exhibition, held in Glasgow in September, attracted about 40,000 trade buyers, it was reported at a meeting of the General Committee in Glasgow on 6 December. Business done is regarded as 'sufficiently in excess of £10,000,000.'

Dunlop Awards

Twelve cash awards for successes in chemistry have been made to Dunlop employees this year under the company's education scheme. Another twelve have been given for successes in physics and applied physics, and three for metallurgy. All told, 192 awards, amounting to £1,857, have been made to employees in this country during the year for successes in a wide range of subjects from baking and confectionery to plumbing.

• OVERSEAS •

Output Doubled

In the post-war years the value of the output of Canada's chemical industry has more than doubled, rising from $376,288,000 in 1946 to $847,850,000 in 1953.

Israel Exports Rise

In the first seven months of the year, Israel's exports of potash were worth $347,514, while phosphates earned $44,435. Chalk was exported for the first time, a 99.9 ton shipment fetching $3,300. A 100 per cent increase in chemical exports was mainly due to the trade in pharmaceuticals and paints.

New Yugoslav Factories

Since the end of the war, the chemical industry in Yugoslavia has opened 23 new factories. Nine lead and zinc mines have been opened, two antimony mines, three bauxite mines and one manganese mine have also come into operation during that period.

Bounty 'Inadequate'

The directors of Courtaulds (Australia) are to approach the Australian Government because they claim that the bounty of 6d. a lb. on continuous filament acetate rayon recently announced (THE CHEMICAL AGE, 1954, **71**, 998) is inadequate.

Natural Gas for Europe

The Foreign Operations Administration of the US, which has made a special study of the subject, estimates that some 400,000,000 cu. ft. natural gas a day would be available from Saudi Arabia for shipment to Europe. The total capital investment required for special tankers, liquefaction plant, storage facilities, pipelines, etc., would be in the region of £125,000,000 and the saving would amount to about 4,000,000 tons of fuel oil or 5,500,000 tons of coal a year.

New Synthetic Rubber

A new synthetic rubber said to have all the properties of natural rubber has been developed by research scientists of the Goodrich-Gulf Chemicals Company, it is claimed in New York. Production costs of the new rubber will be higher than those of both natural rubber and the present synthetic variety. It is made from different materials from those at present used.

Record Indian Figures

The total value of manganese ore produced in India in 1953, was Rs. 294,000,000; of gypsum Rs. 2,800,000, of chromite Rs. 2,500,000, and of bauxite Rs. 788,000, all of which are record figures.

French Steel Output Up

French raw steel production in November reached the record figure of 955,000 tons, compared with 944,000 tons in October and 819,000 tons in November last year. Pig-iron production was 827,000 tons against 839,000 and 671,000 tons respectively.

US Engineers Form Two Subsidiaries

The Lummus Co., of New York, well known as engineers to the oil-refining industry, have recently established two subsidiaries at The Hague. One is Lummus Nederland NV, and the other, established jointly with Werkspoor NV of Amsterdam, is known as Lummus-Werkspoor Technische Maatschappij NV.

Israeli Firm's Production Up

A total of 14,632 tons of sulphuric acid, 23,028 tons of superphosphates, and 852 tons of poultry food additive were produced between 1 July and 30 September by the Fertilisers and Chemicals Company of Haifa, Israel. These figures compare with the 2,875 tons of sulphuric acid, 5,091 tons of superphosphates, and 529 tons of poultry food additive produced during the corresponding period last year.

Sorbic Acid Unit

A new sorbic acid production unit, designed to meet the expanding demand for sorbic acid as a mould inhibitor in foods, has been authorised, and construction is already under way at South Charleston, West Virginia, USA, at the plant of Carbide and Carbon Chemicals Company, a Division of Union Carbide and Carbon Corporation. The unit is scheduled for completion in the spring of 1955. Demand for sorbic acid exceeds production capacity of the present pilot plant and requires construction of larger facilities. If yields can be improved in the new large unit, lower selling prices should be possible.

PERSONAL

MR. F. W. DALE has been appointed divisional chemist for the British Electricity Authority in the North-West. He held a similar post in the former Merseyside and North Wales division of BEA, now merged with the North-West.

DR. F. S. GORRILL, M.D., M.R.C.P., F.R.C.S., B.Sc., has been appointed deputy managing director of Evans Medical Supplies Ltd. Dr. Gorrill joined the company as deputy medical director of The Evans Biological Institute on 8 February, 1951, and became production director with a seat on the board on 1 December, 1951.

At the annual general meeting of the British Association of Chemists on 11 December the following officers were elected for the ensuing year: *President*, MR. G. T. GURR, F.R.I.C.; *Vice-Presidents*, DR. A. T. HEALEY, B.Sc., Ph.D., D.I.C., F.R.I.C., A.M.I.Chem.E., MR. L. E. PUDDEFOOT, B.Sc., MR. F. SCHOLEFIELD, M.Sc., F.R.I.C., MR. J. WILSON, M.C., M.Sc. F.I.R.I., F.R.I.C.; *Hon. Treasurer*, MR. H. R. NEACH, F.R.I.C.; *Hon. Secretary*, DR. F. W. KAY, M.Sc., Ph.D.; *Hon. Registrar*, MR. H. L. HOWARD, B.Sc., A.R.C.S., D.I.C., F.R.I.C., M.I.Chem.E.; *Trustees*, MR. C. S. GARLAND, B.Sc., A.R.C.S., F.R.I.C., M.I.Chem.E.; DR. HERBERT LEVINSTEIN, M.Sc., Ph.D., M.I.Chem.E., MISS W. WRIGHT, B.Sc., A.R.I.C.; *Hon. Editor*, MR. H. WARSON, B.Sc., F.R.I.C. General councillors, to fill four vacancies, were as follows; MR. F. C. BUCKLEY, A.M.C.T., A.R.I.C., MR. T. Q. MATTHEWS, MR. E. H. G. SARGENT, A.C.G.F.C., MR. R. J. WILKINS, B.Sc., F.R.I.C. Section councillors elected to take office following the annual general meeting were: *Birmingham*, MR. F. A. OLIVER, B.Sc., F.R.I.C.; *Liverpool*, MR. G. A. DUNN, A.R.I.C., MR. R. J. MOLLARD; London (Area No. 1), DR. A. W. MIDDLETON, B.Sc., Ph.D., F.R.I.C., MR. C. H. PRICE, B.Sc., F.R.I.C.; *London (Area No. 2)*, MR. A. J. BAKER, MR. V. J. POTTER; *Manchester*, MR. N. DAVENPORT, MR. T. A. HEPPENSHALL, M.Sc., F.R.I.C.; *Notts and Derby*, MR. J. A. HAWKES, B.Sc., M.Sc., A.R.I.C., MR. W. J. THREADKELL, B.Sc.; *Yorkshire*, MR. E. DOOLEY.

Newton, Chambers & Co. Ltd. announce that SIR SAMUEL ROBERTS, chairman of the company and of N.C. Thorncliffe Collieries, has tendered his resignation from the boards of both companies as from 31 December. MR. PETER G. ROBERTS, MP, has been appointed chairman of Newton, Chambers as from 1 January.

MR. H. E. F. PRACY, manager of the Heysham Oil Refinery, Lancs, since 1948, retired on 30 November after 27 years' service with Shell. Born in 1894, Mr. Pracy was educated at Christ's Hospital School and Christ's College, Cambridge. Before joining Shell, he served three war years with the Ministry of Munitions and seven years in the chemical industry. During his oil career, he has filled a number of executive positions, first overseas and later at home. After spells of duty in British Borneo and Trinidad he became manager of Shell Haven Refinery, Essex (1942-44), and general manager of Stanlow Refinery, Cheshire (1944-48). Societies of which Mr. Pracy has long been a member are the Institution of Chemical Engineers (of which he is at present vice-chairman and chairman-elect of the North Western Branch), the Institute of Petroleum, and The Royal Empire Society. On his retirement, Mr. Pracy also relinquishes the appointment of general manager of Trimpell Ltd. (The site at Heysham is occupied both by an oil refinery operated by Shell and by a chemical works operated by I.C.I. Trimpell Ltd. is a service company, operated by and on behalf of its two parent companies.) His successor as manager of Heysham Oil Refinery is MR. M. WILLCOCKS, formerly assistant manager of Shell Haven Refinery, and as general manager of Trimpell Ltd., MR. E. BEESLEY, who comes to Heysham from I.C.I. Billingham Division, Technical Department.

The following officers and council members have been elected by the National Paint Federation: *President,* MR. E. B. CALVERT (Blundell, Spence & Co. Ltd.); *Vice-President,* MR. R. C. SISSONS (Sissons Brothers & Co. Ltd.); *Council,* MR. J. W. ADAMSON (British Paints Ltd.); MR. D. L. ANNAND (The Ault & Wiborg Group); MR. H. W. G. BIDGOOD (I.C.I. Ltd., Paints Division); MR. G. D. BUTLER (Mander Brothers Ltd.); MR. E. B. CALVERT (Blundell, Spence & Co. Ltd.); MR. E. C. COVERDALE (Permoglaze Ltd.); MR. R. ASHLEY HALL (John Hall & Sons [Bristol & London] Ltd.); MR. H. E. HARRISON (Hangers Paints Ltd.); MR. C. J. MILLAR (Montgomerie, Stobo & Co. Ltd.); MR. F. W. NEWBATT (Goodlass, Wall & Co. Ltd.); MR. G. E. SANDERSON (A. Sanderson & Co. Ltd.); MR. R. C. SISSONS (Sissons Brothers & Co. Ltd.); MR. D. SMITH (Smith & Walton Ltd.); MR. K. B. WILSON (The Walpamur Co. Ltd.) and MR. E. C. WINGROVE (Vulsan Products Ltd.).

MR. JAMES RITCHIE has been appointed financial director of the British Aluminium Co. Ltd. as from 1 January next year. He will relinquish his position as secretary and will be succeeded by MR. H. A. WOODROFFE.

MR. RONALD LAYDEN, joint managing director of Trent Valley Glassworks Ltd., has been appointed to the board of the parent company, Glastics Ltd. After 14 years on the technical staff of Beatson Clark & Co. Ltd., where he was in charge of laboratory controlling, raw materials, glass compositions, metal furnaces and annealing, Mr. Layden joined Trent Valley Glassworks in 1947. Since then he has been responsible for developing the manufacture of high quality perfume and medical bottles and pressed glass. Mr. Layden joined the board of Trent Valley Glassworks as technical director in 1950, and was appointed joint managing director in January 1951.

The British Non-Ferrous Metals Research Association announce that DR. MAURICE COOK, Ph.D., D.Sc., F.I.M. (joint managing director of the Metals Division of Imperial Chemical Industries) has been elected chairman of the association as from 1 January next in succession to the HON. R. M. PRESTON who retires from office at the end of this year. Dr. Cook is a graduate of both Cambridge and Manchester universities and is distinguished for his services to the metallurgical industry and profession. He has made many contributions to the science and technology of non-ferrous metallurgy in numerous papers published in the *Journal of the Institute of Metals* and elsewhere. He is a past-president of the Institution of Metallurgists and senior vice-president and president-elect of the Institute of Metals. He is a member of council of the Aluminium Development Association and has served over many years on a large number of industrial and Government councils and committees dealing with metallurgical matters. He has been active in the affairs of the research association for many years, having been a member of council since 1940, a vice-chairman since 1951 and a member of the finance and general purposes committee since 1942. He has been chairman of the Research Board since 1950.

The following appointments are announced by Price's (Bromborough) Ltd.: MR. B. R. HOOK, formerly products development manager, becomes general sales manager and MR. T. A. WINNEY, formerly assistant sales manager, becomes home sales manager. MR. J. L. CRAIG, who has been with the firm since 1919, has resigned the position of sales manager because of ill health.

SIR EDWARD T. F. CROWE, younger brother of the late Mr. G. W. CROWE, chairman and founder director of Croda Ltd., who died in June, has been elected chairman of the board.

MR. ARTHUR CARROLL has been appointed to the board of the Birmingham Chemical Co. Ltd., a subsidiary of the Staveley Coal & Iron Co. Ltd.

Obituary

The death occurred on 10 December of MR. WILLIAM N. BACON, B.Sc., F.I.C., F.R.I.C., who was 82. A consulting chemist, Mr. Bacon went into partnership with the late Mr. Sindall in the early days of the century to start the consultant firm of Sindall & Bacon, whose offices were at first in Walbrook in the City of London. When these premises were destroyed by enemy action in 1941 the firm moved to Buckingham Palace Road, where Mr. Bacon continued to work, retiring only in September, 1953. He was made a Fellow of the Royal Institute of Chemistry in 1908 and was a member of the council from 1919 to 1922. He was also a member of the Corporation of the City of London.

Publications & Announcements

THE increased use of analytical balances for routine weighing in connection with process control has spotlighted the problem of wear and tear on knife edges. In answer to this problem, Stanton research department after careful investigation and exhaustive tests, has produced what is claimed to be absolutely foolproof and reliable 'Synchro-release' mechanism which automatically controls high-speed release and arrestment. This device eliminates the possibility of impact damage on knife edges and means that routine weighing can be left in the hands of unskilled assistants. An illustrated 4-page folder giving full details of this new device can be obtained from Stanton Instruments Limited, 119 Oxford Street, London W.1.

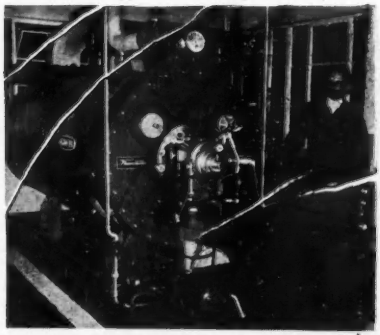
* * *

A PRODUCT recently introduced in this country to solve the problem of seizing and galling of threaded connections subjected to prolonged exposure to extreme heat is Thred-Gard, a special compound which, when painted on the surface of the bolt or stud before being fitted, protects the thread against this welding action. A non-drip and non-hardening substance manufactured by Crane Packing Ltd. of Slough, Bucks, Thred-Gard lubricates and protects the threaded surface of studs, bolts, plugs, etc. Wrench torque is thus greatly reduced, and fittings can be drawn up to a greater degree of tightness. Seizing and galling is prevented at operating temperatures up to 1,200° F, yet threaded connections can be easily disassembled. Other applications for Thred-Gard include protection for thread cutting dies and taps, broaching and spinning tools, wire drawing dies, lathe centres, steady rests, rock drill pipe and bit threads. An illustrated leaflet and supplies of Thred-Gard can be obtained from Crane Packing Ltd. of Slough, England.

* * *

A NEW Quasi-Arc welding set—type ACP. 190—has been recently developed. It is air cooled, and has an output ranging from 20 to 190 amp., with an open circuit voltage of 60V; it is designed to BS.638, Group X. The external appearance is of clean modern lines, and the set is transportable, being fitted with two small wheels and a towing handle, as well as two lifting handles. The operator can select any one of 35 settings for a wide range of work, and at the lower end of the range the current can be varied in steps as small as 1 amp. The transformer is so arranged that it may be connected to supply voltages ranging from 190 to 250 V and 380 to 480 V. The set may be provided with a built-in capacitor for power factor correction, and insulation throughout in Class B.

* * *



The first Powermaster packaged boiler (see THE CHEMICAL AGE, 1954, 70, 891) has been installed in the laundry of Replacement Cleaners Ltd., Treforest. This is a Model 50, and is seen working at 100 psi. The unit is completely self-contained, and it will be seen that no foundations were necessary. The boiler is smoke-free, and the boiler-room is therefore extremely clean. Powermaster boilers are made by G.W.B. Furnaces Ltd., Dudley

* * *

A NEW catalogue describing their range of analytical balances has been issued by J. W. Towers and Co. Ltd., Victoria House, Widnes. With it is an offer to install any of the balances free of charge on a seven days' trial within 50 miles of Widnes or any of the branch offices, Manchester, Liverpool, Stockton-on-Tees and Uxbridge. Particular attention is drawn to Model 205 automatic direct reading balance which is claimed to be the fastest weighing analytical balance in the country and, because of this, the most economical, the initial cost being covered by the saving of the operator's time.

THE September/October issue of *Foundry Practice* published by Foundry Services Limited of Nechells, Birmingham 7, describes an investigation carried out by the firm into a gunmetal valve body that leaked under hydraulic pressure. There are also the second parts of articles on 'Cutting Costs in a Light Alloy Sand Foundry' and 'Pressure and Exothermic Feeding of Iron Castings.' Included in the publication is a brochure giving some details of Foseco products and a card asking for suggestions for subjects for future articles.

* * *

IT is not always possible to fumigate foodstuffs and other stored products in the most efficient way—in specially designed gas-tight chambers—because of handling difficulties. Sometimes it is possible to carry out fumigation by sealing a whole warehouse but this cannot always be done, either because the store is impossible to seal or because only part of the contents require treatment. An alternative way of doing the job is by fumigating stacks of stored goods under gas-proof sheets. Pest Infestation Research Bulletin No. 1, 'Fumigation with Methyl Bromide under Gas-Proof Sheets,' has just been published by HMSO for DSIR, price 2s. 6d.

The most effective fumigant to use with gas-proof sheets has proved to be methyl bromide. Early experience of the method was confined to the fumigation of small stacks which could be covered by a single sheet but it is now possible to treat very large stacks of materials in buildings or in the open air by using a number of overlapping sheets. Stocks of up to 3,000 tons have been dealt with in this way. Methods have been developed for applying the methyl bromide so that satisfactory distribution of the gas is obtained and it has been found that losses by leakage can be kept to a minimum if the stack is properly prepared.

The bulletin describes the physical and chemical properties of methyl bromide, the preparation of the stacks for fumigation and the training of operators. Sections deal with the handling of the fumigant, including transfer from large to small containers, the procedures and equipment for applying the fumigant and methods of airing the stack after fumigation. Detailed specimen instructions to operators-in-charge are given together with methods of determining the effectiveness of a fumigation.

REVISED version of Technical Bulletin No. 2: 'Melamine-Formaldehyde Resins for Laminates and Adhesives' has just been published by the British Oxygen Co. Ltd., Chemicals Division, Vigo Lane, Chester-le-Street, Durham. The purpose of this bulletin is to describe the general procedures for making resin syrups suitable for laminating and adhesives. Resins using a melamine/formaldehyde ration of 1:3 are described, since these are suitable for most purposes, but the molecular ratio may be adjusted to particular requirements.

* * *

REPRINTS available from the Tin Research Institute, Perivale, Middlesex, are 'Investigations on Organo-Tin Compounds: Parts I and II, Preparation of Butyl-Tin Compounds by a Wurtz Reaction' and 'Part III, Biocidal Properties of Organo-Tin Compounds' by G. J. M. van der Kerk and J. G. A. Luijten (*J. Appl. Chem.* 1954, **4**); 'Improved Aluminium-Tin Bearing Alloys,' by J. W. Cuthbertson and E. C. Ellwood (*Metal Industry*, 1954, **5**, 85); and 'Some Aspects of Tinning by Immersion Processes' by D. E. Weimer and J. W. Price (*Trans. Inst. Metal. Finishing*, **30**).

* * *

BECAUSE mercury freezes at about −38° C, some other medium must be employed in thermometers intended for use below this temperature. The alloy of mercury with thallium, which freezes at −58° C, involves a number of technical problems not encountered in the manufacture of mercury-in-glass thermometers. H. J. Elliott Ltd., of the E-Mil Works, Treforest, now claim to have overcome these problems, and are producing thermometers in commercial quantities. A typical pattern is IP.65C, with a range −51.6° to −34° C, subdivided in 0.1°; others are available in Fahrenheit scales, and with NPL or works certificate.

* * *

LATEST addition to the range of emulsifiers available from Croda Ltd., Snaith, Goole, Yorkshire, is Crill K.16, a technically pure grade of sorbitol mono-oleate. It is a viscous amber-coloured material, producing water-in-oil emulsions, and acting as an auxiliary oil-in-water emulsifier; it is soluble in oils, etc., but insoluble in water; and it is stable to mineral acids, dilute alkali and solutions or electrolytes.

Law & Company News

Commercial Intelligence

The following are taken from the printed reports, but we cannot be responsible for errors that may occur.

Mortgages & Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described herein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages or Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary but such total may have been reduced.)

PORTLAND PLASTICS LTD., Hythe (Kent). 11 November, debenture to Bowmaker Ltd. securing all moneys due or to become due to the holders; charged on specified machinery. *Nil. 24 September, 1953.

Satisfaction

BRITISH CELANESE LTD., London, W. Satisfaction, 3 November, of debenture stock registered 2 October, 1943, and 8 November, 1944, to the extent of £9,712.

Changes of Name

The following changes of name have been announced: CAMBRIAN CHEMICAL INDUSTRIES LTD. to CAMBRIAN ENGINEERING INDUSTRIES LTD., on 18 October. 'ALDIMEX' (ALDWYCH IMPORTING AND EXPORTING) CO. LTD., to ALDIMEX LTD., on 15 October.

Company News

A. Boake Roberts & Co. (Holding) Ltd.

The directors of A. Boake Roberts & Co. (Holding) Ltd. have declared an interim dividend of 4 per cent for the year ending 31 March, 1955. This compares with last year's payment of 2½ per cent. If the profits of the first half of the year are reasonably maintained in the second half, the directors hope it may be possible to recommend a final dividend not exceeding 11 per cent. Previously, a 7½ per cent final was paid to make a total of 10 per cent.

British Benzol & Coal Distillation

British Benzol and Coal Distillation propose a final dividend of 12½ per cent, to make a total of 17½ per cent for the year to 31 October. Profit, after all charges, is £59,220, compared with £56,222 for the previous year.

Powell Duffryn Ltd.

Powell Duffryn Ltd. announce an interim dividend of 3 per cent actual, less income tax, on the £9,660,471 ordinary stock in respect of the year ending 31 March, 1955. Payment to be made on 31 January, 1955, to holders registered on the books of the company at close of business on 8 December, 1954.

Reckitt & Colman Holdings Ltd.

Reckitt and Colman Holdings Ltd. have offered to buy the whole of the issued preference and ordinary capital of H. W. Carter & Co. Ltd., involving a total of £1,185,000. The directors of Carters have recommended acceptance of the offer.

Scottish Agricultural Industries Ltd.

The board of Scottish Agricultural Industries Ltd. recommends a dividend on the ordinary capital of 11 per cent for the year ended 30 September. This compares with 9 per cent for the previous year. Net profit of the group after taxation was £448,478 (£398,835). More than 60 per cent of the equity is owned by I.C.I.

The Staveley Coal & Iron Co. Ltd.

A satisfactory earnings increase in income was reported at the annual general meeting of the Staveley Coal and Iron Co. Ltd. on 1 December. Earnings of the group, which includes among other subsidiaries, the British Soda Co. Ltd. and the Birmingham Chemical Co. Ltd., rose from £1,521,113 last year to £2,198,458 this year. Net profit after taxation was £1,073,931.

Styrene Co-Polymers Ltd.

Styrene Co-Polymers Ltd. have now appointed agents to represent them in Hong Kong and on the China mainland. The firm with whom an agreement has been signed is Swire & Maclaine Ltd., 1 Connaught Road Central, PO. Box 579, Hong Kong. During November the agreement between Styrene Co-Polymers Ltd. and their Italian agents, SACI, was terminated.

[continued on page 1320

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Wailes Dove Bitumastic Ltd.

Wailes Dove Bitumastic Ltd., manufacturers of and contractors for anti-corrosive coatings, announce a final dividend of 25 per cent and a bonus of 2½ per cent, making a total of 37½ per cent for year ended 30 September. This compares with the previous year's total of 35 per cent, which included a 5 per cent Coronation bonus. Net profit after tax was £77,636, against £57,720.

Willows Francis Pharmaceutical Products Ltd.

Net profit of Willows Francis Pharmaceutical Products Ltd. for the year ended 30 June amounted to £63,596, before taxation, against £46,600. Turnover reached record levels during the year and monthly returns show a continued expansion of sales. A final dividend of 7½ per cent will be proposed at the annual general meeting on 29 December. At an extraordinary general meeting, which is to follow immediately the board will recommend that the name of the company should be changed to Willows Francis Ltd.

Charles Winn & Co. Ltd.

Profit, before taxation, of Charles Winn and Co. Ltd. for the year ended 31 July was £40,597, after crediting £6,000 over provision for stock. This compares with £47,569 for the previous year. A dividend of 10 per cent (same) is recommended for the annual meeting on 5 January.

Imperial Chemical Industries of Australia & New Zealand Ltd.

The board of Imperial Chemical Industries of Australia and New Zealand Ltd. is raising the ordinary dividend for the year ended 30 September to 8 per cent, compared with 7 per cent paid for each of the three previous years. The interim payment of 3½ per cent compared with the previous 2½ per cent, and the final dividend is unchanged at 4½ per cent.

Next Week's Events

MONDAY 20 DECEMBER

Society of Cosmetic Chemists of Great Britain

London: Royal Society of Tropical Medicine and Hygiene, Manson House, 26 Portland Place, W.1, 7 p.m. 'The Penetration of Fatty Matter into Skin' by Dr. K. G. A. Pankhurst.

British Ceramic Society

Stoke-on-Trent: North Staffordshire Technical College, 7.30 p.m. Pottery Section. 'The Application of Ultrasonics to Non-Destructive Testing of Materials' by J. D. Hislop.

WEDNESDAY 22 DECEMBER

Society of Instrument Technology Ltd.

Cheltenham: Civic Playhouse lounge, Bath Road, 7.30 p.m. 'Recording Instruments' by J. Beard.

Market Reports

LONDON.—Conditions on the industrial chemicals market have changed very little during the past week, the chief interest being centred on contract replacement business. Prices generally remain steady and the revisions of price schedules for 1955 which are now under consideration are not expected to be extensive. A firm undertone continues in the coal tar products market with a steady inquiry for the creosote oils and the light distillates.

MANCHESTER.—Contract deliveries of heavy chemicals during the past week to users in the Lancashire and West Riding areas have kept up fairly well, though at the moment the approach of stocktaking operations and other seasonal influences has had the usual effect of curtailing fresh buying and somewhat quieter conditions in this respect have been reported on the Manchester market during the past week. The movement on export account has been about maintained. A quiet demand for most classes of fertiliser materials has been reported. Deliveries of most of the light and heavy by-products have again been on steady lines.

GLASGOW.—Trading followed more or less the same pattern as that of last week with some very interesting price changes notified to come into effect from the beginning of the new year; more information will be available about these later. As with last week, the period just past has been quite satisfactory and it is expected that trading until the end of the year will not show much change. Export, if anything, has been a shade busier during this week.

CLASSIFIED ADVERTISEMENTS

SITUATIONS VACANT

The engagement of persons answering these advertisements must be made through a Local Office of the Ministry of Labour or a Scheduled Employment Agency if the applicant is a man aged 18-64 *inclusive, or a woman aged* 18-59 *inclusive, unless he or she, or the employment, is excepted from the provisions of the Notifications of Vacancies Order,* 1952.

A. BOAKE, ROBERTS & CO., LTD., CARPENTERS ROAD, LONDON, E.15, require the services of **SHIFT CHEMISTS** for Plant Control work. Academic qualifications will be an advantage, but are less essential than industrial plant experience. The work is interesting and varied, and the appointments will be progressive. There is every opportunity for advancement. Initial salary will be in the range of £600 to £700 per annum.

Applications plainly marked "Shift Chemists," to **PERSONNEL MANAGER.**

A. BOAKE, ROBERTS & CO., LTD., LONDON, E.15, require **SENIOR CHEMISTS** for their Process Development Department. These appointments would appeal to qualified men with some years of experience of Organic Chemistry, seeking the opportunity to lead a team in developing new projects from laboratory to plant scale, so as to provide new or improved products. The minimum salary envisaged is £800 per annum.

The company also requires **ASSISTANT CHEMISTS** to participate in these projects. Industrial chemical experience is desirable in these appointments. Minimum salary is £550 per annum. Applications in detail to **PERSONNEL MANAGER.**

PRODUCTION SUPERINTENDENT

CHEMIST, with production experience, required to take charge of large continuous chemical process department. Progressive plant situated on Merseyside. Minimum qualification, A.R.I.C. Good salary and prospects. Pension Scheme. Applications, which will be treated confidentially, should state present salary, age, qualifications, details of experience, in chronological order, and be addressed to Personnel Manager, Box B965, Lee & Nightingale, Liverpool.

THE Technical Service Department of a Chemical Company manufacturing products for the Plastics, Rubber, Paint and Lubricating Grease Trades, requires a **CHEMIST** or **TECHNOLOGIST** with industrial experience in one or more of these fields. The work includes customer liaison, answering technical inquiries and the preparation of technical literature. The situation calls for a man with personality and interest in customers' problems. Salary in accordance with age, qualifications and experience. Apply **PERSONNEL MANAGER, A. BOAKE, ROBERTS & CO., LTD., 100, CARPENTERS ROAD, STRATFORD, LONDON, E.15,** marking envelope "Technical Service."

WORKS CHEMIST

RAYON Yarn Producers require a Works Chemist, minimum qualifications, A.R.I.C., for investigation of process problems. Applicants should have experience in chemical process work and preferably also in textile technology.

Good salary and prospects. Pension Scheme; five-day week; canteen; sports and social facilities. Applications, which will be treated in strict confidence, should state age, qualifications, details of experience and present salary, and be addressed to Personnel Manager,

BRITISH ENKA, LTD., AINTREE, LIVERPOOL, 9.

SITUATION WANTED

MAY I, for the last time of asking, inquire whether any employer could utilise my services in any reasonable capacity? I am a M.Sc. (1st Class), with a life-time experience in the asphalt and colouring matter industry, and although ticking 60 I am as alert as ever. I would consider anything—even a clerical post—which would enable me to remain in the trade. **BOX No. C.A. 3373, THE CHEMICAL AGE, 154, FLEET STREET, LONDON, E.C.4.**

FOR SALE

CHARCOAL, ANIMAL AND VEGETABLE horticultural, burning, filtering, disinfecting, medicinal, insulating; also lumps ground and granulated; established 1830; contractors to H.M. Government.—**THOS. HILL-JONES, LTD., "INVICTA" WORKS, BOW COMMON LANE, LONDON, E. TELEGRAMS: "HILL-JONES, BOCHURCH LONDON." TELEPHONE: 3285 EAST.**

FOR SALE **No. 5 BRITISH REMA BALL MILL**—silex lined; half ton per hour 180/200 mesh, together with bunkers, separator, driving motors, drives, swing hammer, K.B. crusher and general structure. Presently in use. **CHARLES TENNANT & CO., LTD., 22, BLYTHSWOOD SQUARE, GLASGOW, C.2. CENTRAL 2291.**

MARCHANT BROS. **TRIPLE GRANITE ROLLER MILL.** Rolls 9 in. diam. by 16 in. wide lat motion, fast and loose pulleys 3 in. face by 21 in. diam. £80.

CHANGE PAN PAINT MIXER. Pans 18 in. diam. by 22 in. deep. Fast and loose pulleys 2½ in. face by 10 in. diam. £35. Good condition.

THOMPSON & SON (MILLWALL), LTD., CUBA STREET, MILLWALL, E.14. Tel. EAST 1844.

ONE **BERTRAM TWIN ROLL FILM DRIER,** with steam-heated rolls 60 by 28, complete with motor, starter, vapour hood, etc. In first-class condition.

One **SCOTT VACUUM OVEN**—inside measurements approx. 6 ft. by 6 ft. by 5 ft., with vacuum pump and belongings.

Six Brand New **STERILISING VESSELS**—7 ft. long by 3 ft. diam.

One 4 ft. Positive-driven **EDGE RUNNER MILL,** with reduction gear, motor and starter.

One S.J. **WERNER MIXER** with pan approx. 2 ft. by 2 ft., of the tilting type.

Two Steam-jacketed **CAST-IRON FILTER PRESSES,** each with 38 s.j. plates and 39 frames, cake size 2 ft. 4 in. square.

Several Johnson **CAST-IRON FILTER PRESSES,** various sizes and types.

GARDNER Mixers, and Mixers and Sifters combined, sizes "E," "G," "H," "J" and experimental.

HYDRO EXTRACTORS—24 in., 30 in. and 36 in.
Two Gardner "H" size Steam-jacketed **MIXERS.**
Two 18 in. **KEK PLATE MILLS,** with feeders, delivery bins, motors and entablature.

RICHARD SIZER, LTD., ENGINEERS, HULL.

Telephone: 31743.

FOR SALE

MORTON, SON AND WARD, LIMITED,

STAINLESS STEEL Vessels all shapes and sizes, jacketed or unjacketed, with stainless steel mixing gear, to requirements; also stainless steel storage and vacuum vessels.

"MORWARD" "U"-shaped TROUGH MIXERS—up to 2 tons, in stainless steel, with agitators, scroll or paddle type, jacketed or unjacketed.

STAINLESS STEEL TROUGHS, TANKS and **CYLINDERS** made to requirements.

Above items can also be fabricated in mild steel.

JACKETED PANS

100g., 150g. and 200g. in stock, new, in mild steel, for 100 lb. p.s.i. w.p., with or without mixing gear.

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500 gal.—5 ft. 9 in. by 4 ft. 6 in. (New and Second-hand).

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THE Proprietor of British Patent No. 644,030, entitled **"IMPROVEMENTS IN THE PRODUCTION OF CARBON DISULPHIDE,"** offers same for licence or otherwise, to ensure its practical working in Great Britain. Inquiries to **SINGER, STERN & CARLBERG, CHRYSLER BUILDING, NEW YORK 17, N.Y., U.S.A.**

THE Office National d'Etudes et de Recherches Aeronautiques, 55 Bd Malesherbes, Paris, France, holder of British Patent No. 685,920, dated January 14th, 1953, **"IMPROVEMENTS IN THE MEASUREMENT OF THE PROPORTION OF A PARAMAGNETIC GAS, IN PARTICULAR OXYGEN, CONTAINED IN A GASEOUS MIXTURE,"** should like to deal with constructors in Great Britain through licensing.

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Printed in Great Britain by THE PRESS AT COOMBELANDS LTD., Addlestone, and published by BENN BROTHERS LTD., at Bouverie House, 154, Fleet Street, E.C.4, 18 December, 1954. Registered at the General Post Office. Entered as Second Class Matter at the New York, U.S.A., Post Office.